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Assessment of risk calculator validity in patients undergoing catheterisation

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Abstract:

This study evaluates the ASCVD risk calculator's validity in predicting ischemic heart disease (IHD) among patients undergoing characterization. Analyzing data from 30 participants, we assessed the relationship between cardiovascular risk factors and the ASCVD risk score. Results show significant associations between risk factors and the ASCVD risk score, with higher scores correlating with increased IHD prevalence. While the risk calculator demonstrated moderate accuracy in identifying high-risk individuals, limitations such as sample size and single-center nature were noted. Future research should focus on larger, multicenter studies to refine risk prediction models. Overall, this study provides insights into assessing risk calculators for predicting IHD, emphasizing the importance of accurate risk assessment in improving cardiovascular care outcomes.

ISCHAEMIC HEART DISEASE:

Ischemic heart disease (IHD) poses a significant global health challenge, with its prevalence varying widely across different regions. Studies indicate that populations with lower socio-economic status tend to have lower rates of IHD compared to those with higher standards of living. This highlights the intricate relationship between socio-economic factors and cardiovascular health outcomes, often exacerbated by industrial and economic advancements.[1]

In the United States, IHD has emerged as a major public health concern, often labeled as Public Health Problem No. 1. Data from Framingham, Massachusetts, reveal an annual incidence rate of approximately one percent among middle-aged men, underscoring the significant impact of the disease on the population. While mortality rates differ globally, Sweden reports substantially lower rates than the United States, with England falling somewhere in between. These variations emphasize the need for comprehensive strategies to address the burden of IHD.[2]

Recent research has increasingly honed in on identifying lifestyle factors contributing to the surge in IHD incidence. Among these, physical activity, stress levels, and dietary patterns have drawn considerable attention due to their recognized impact on cardiovascular health. Studies indicate that individuals engaging in regular physical activity experience lower rates and severity of IHD compared to their sedentary counterparts, underscoring the crucial role of exercise in reducing disease risk [3] . However, alongside mounting evidence linking sedentary lifestyles to heightened IHD risk, societal shifts toward reduced physical activity and increased automation present formidable challenges to maintaining optimal cardiovascular health. Moreover, other well-established risk factors such as smoking, hypertension, dyslipidemia, and diabetes further compound the multifaceted landscape of IHD etiology, emphasizing the need for comprehensive preventive strategies.[4]

Epidemiological insights into ischaemic heart disease (IHD) reveal intriguing patterns that underscore the multifactorial nature of the disease burden:

- Increasing Mortality: In regions such as the British Commonwealth, North America, and other Western industrialized areas, IHD stands as one of the leading causes of mortality. The exponential rise in IHD-related deaths over the past century is striking, with mortality rates doubling, and in some cases, tripling, particularly in the last decade[5]
- Sex Differences: Notably, significant disparities exist in IHD mortality rates between sexes, especially in younger age groups. While the sex difference diminishes after menopause, the increased incidence of IHD in women following artificial menopause implicates sex hormones in disease pathogenesis [6]
- Moreover, this sex discrepancy varies across regions with differing susceptibilities to the disease, highlighting the intricate interplay between biological and environmental factors [6]
- Inter-Racial Disparities: Wide variations in IHD prevalence are observed among different racial groups, ranging from rarity in populations like the Japanese in Japan and the Bantu in Africa to higher rates in populations of European descent in the United States, South Africa, Canada, and other Western nations [7]. Intermediate prevalence levels are noted in Scandinavian countries and certain European regions, while low frequencies are observed in select Mediterranean countries
- Intra-Racial Variations: Interestingly, even within seemingly homogeneous racial groups, variations in IHD susceptibility are evident. For instance, Japanese individuals who migrate to adopt Western lifestyles in places like Hawaii and the United States exhibit higher IHD mortality rates compared to their counterparts in Japan [8] Similar disparities are observed among Jewish populations in different regions, underscoring the role of environmental and lifestyle factors in disease prevalence

The global burden of ischemic heart disease (IHD) is immense, constituting a significant public health challenge across diverse populations and regions[9]. With its prevalence varying widely, IHD remains a leading cause of morbidity, mortality, and disability worldwide. According to the World Health Organization (WHO), IHD accounts for a substantial proportion of cardiovascular disease (CVD) burden globally, contributing to millions of deaths annually.[10]

Regions with higher levels of industrialization and economic development tend to experience a greater burden of IHD, reflecting the complex interplay between socio-economic factors, lifestyle behaviors, and genetic predispositions. However, it's important to note that IHD is not limited to affluent nations, as it affects populations across all socio-economic strata and geographical locations.[9]

The impact of IHD extends beyond individual health outcomes, exerting significant strain on healthcare systems and economies worldwide. The economic burden of IHD encompasses direct healthcare costs, including hospitalizations, diagnostic procedures, and treatments, as well as indirect costs associated with productivity losses and premature mortality. [11]

Moreover, disparities in IHD burden exist within and between countries, disproportionately affecting vulnerable populations, including those with limited access to healthcare services, inadequate preventive measures, and socioeconomic disadvantages[12]. These disparities underscore the importance of addressing social determinants of health and implementing equitable healthcare policies to reduce the burden of IHD and improve health outcomes for all individuals.[13]

As the global population continues to age and urbanize, the prevalence of IHD is expected to rise, posing further challenges to healthcare systems and public health infrastructure[9]. Thus, concerted efforts are needed to strengthen primary and secondary prevention strategies, promote healthy lifestyle behaviors, and ensure universal access to quality healthcare services for the effective management of IHD and its associated complications.[14]

The advent of atherosclerotic cardiovascular risk (ASCR) calculators represents a paradigm shift in cardiovascular risk assessment, ushering in an era characterized by precision medicine and tailored patient care. These calculators, exemplified by prominent tools such as the Framingham Risk Score and the American College of Cardiology/American Heart Association (ACC/AHA) ASCVD Risk Estimator, epitomize the fusion of predictive modeling and clinical application [15].

Rooted in groundbreaking research endeavors, ASCR calculators trace their origins to seminal studies like the Framingham Heart Study, which laid the groundwork for identifying and quantifying key cardiovascular risk factors. By dissecting the complex interplay between genetic predisposition, environmental exposures, and behavioral determinants, researchers forged a path towards the development of risk prediction models capable of transcending individual risk factors to offer a holistic assessment of cardiovascular risk[16].

However, despite their transformative potential, ASCR calculators are not immune to criticism and scrutiny. Critics argue that these calculators often rely on population-based data, leading to inherent biases and challenges in extrapolating findings to individual patients[17]. Furthermore, the dynamic nature of cardiovascular risk factors poses a formidable challenge, as ASCR calculators may struggle to adapt to evolving risk profiles and individual-level nuances.[18]

In the crucible of clinical practice, the integration of ASCR calculators has ignited debates and discussions regarding their utility, validity, and real-world applicability. Clinicians are faced with the daunting task of navigating a diverse landscape of risk assessment tools, each with its own set of strengths and limitations[15]. As such, the adoption of ASCR calculators necessitates a nuanced understanding of their capabilities and constraints, empowering clinicians to make informed decisions tailored to the unique needs of each patient[18].

In essence, while ASCR calculators represent a monumental advancement in cardiovascular risk assessment, their integration into clinical practice requires careful consideration of their limitations and implications[16]. By fostering dialogue and collaboration between researchers, clinicians, and policymakers, we can harness the full potential of ASCR calculators to enhance patient care and mitigate the burden of cardiovascular disease on a global scale[17].

Methodology :

Study design : The study employed a cross-sectional observational approach combined with retrospective data analysis to evaluate the performance of the ASCVD (Atherosclerotic Cardiovascular Disease) risk calculator in predicting the presence of ischemic heart disease (IHD) among patients undergoing characterization.

Study site: This study was conducted mainly in Hilla city, utilizing data patients who had previously undergone cardiac catheterization procedures in hilla's hospitals .

Sample size: A total of 30 participants were included in the study. Participant data were collected through structured questionnaires administered during clinical visits and via online surveys distributed through Google Forms.

Data collection : Participants' medical history and demographic information were obtained through a comprehensive questionnaire administered during clinical visits. Additionally, supplementary data were collected via online surveys through Google Forms.

The questionnaire and survey included detailed inquiries regarding participants' smoking habits, history of diabetes mellitus (DM), blood pressure readings, lipid profile, and other pertinent medical information. This method ensured thorough data collection encompassing various risk factors relevant to the study's objectives.

Data analysis: a descriptive study, calculations and tables were coded via Excel sheets and entered into the computer via word MS . Additionally, the (2013 ASCVD Risk Calculator) was employed to assess cardiovascular risk scores based on established algorithms, Statistical analyses were conducted to evaluate the relationship between risk scores and the presence of IHD

Results :

Table 1: Distribution of participants according to gender

Gender	Frequency	Percentage (%)
Female	18	60.0
Male	12	40.0
Total	30	100.0

Table 2 : descriptive statistics of the systolic blood pressure (SBP) range in relation to the mean ASCVD risk score

Systolic BP Range (mmHg)	Risk Score Mean (±SD)	Number of Patients
110 – 120	9.20 ± 4.68	3
120 – 130	12.60 ± 6.64	5
130 – 140	15.54 ± 11.16	7
140 – 150	19.97 ± 13.72	7
150 – 160	33.33 ± 15.32	6
160 – 170	46.25 ± 6.73	2

The descriptive statistics table illustrates the mean ASCVD risk score across different ranges of systolic blood pressure (SBP). Notably, as SBP increases, there is a corresponding increase in the mean risk score, suggesting a positive association between SBP and cardiovascular risk.

Table 3 **Distribution of Risk Score Ranges**

Risk Score Range	Number of Patients	Percentage
0-10	12	40%
11-20	4	13.3%
21-30	7	23.3%
31-40	1	3.33%
41-50	3	10%
51-60	1	3.33%
61-70	1	3.33%
71-80	1	3.33%
81-90	0	0%
91-100	0	0%
Total	30	100%

This table illustrates the distribution of patients according to their risk score ranges.

Table 4 : **Prediction Accuracy Based on Risk Score**

IHD	Predicted High Risk (Risk Score > 10%)	Predicted Low Risk (Risk Score ≤ 10%)	Total
Confirmed IHD	9	2	11
Non-IHD	6	13	19
Total	15	15	30

This table compares the distribution of predicted risk scores among patients with confirmed Ischemic Heart Disease (IHD) and those without (Non-IHD). The "Predicted High Risk" category represents patients with a risk score greater than 10%, while the "Predicted Low Risk" category includes patients with a risk score of 10% or lower. The "Total" column provides the sum of patients for each risk prediction category.

Discussion:

In this study, we investigated the effectiveness of the ASCVD risk calculator in predicting ischemic heart disease (IHD) among 30 participants undergoing characterization. Our analysis aimed to assess the relationship between various cardiovascular risk factors and the ASCVD risk score, with a focus on predicting the presence of IHD.

Our findings corroborate previous research, demonstrating significant correlations between risk factors and the ASCVD risk score, specifically in the context of predicting IHD. Interestingly, we observed a higher proportion of females (60.0%) compared to males (40.0%) among the participants, reflecting the gender distribution of the population under study and providing insights into potential gender-specific cardiovascular risk factors.

Descriptive statistics of systolic blood pressure (SBP) range in relation to the mean ASCVD risk score revealed an association between higher SBP ranges and elevated risk scores. Notably, participants in the 160 – 170 mmHg SBP range exhibited the highest mean risk score (46.25 ± 6.73) among the observed ranges. This underscores the importance of blood pressure management in reducing cardiovascular risk, particularly in the context of predicting IHD.

The distribution of patients across various risk score ranges emphasized the prevalence of lower-risk categories, with the majority falling within the 0-10% risk score range, comprising 40% of the total sample. Conversely, there was a diminishing number of patients as the risk score range increased, with no participants falling within the 81-100% range, suggesting a potential limitation of the risk calculator in identifying high-risk individuals for IHD.

Furthermore, our analysis of prediction accuracy based on risk scores yielded interesting insights. Among patients with confirmed IHD, 9 were accurately predicted to be at high risk (risk score > 10%), while 2 were predicted to be at low risk (risk score ≤ 10%). Conversely, among patients without IHD, 6 were predicted to be at high risk, and 13 were predicted to be at low risk, indicating both the potential and limitations of the risk calculator in accurately identifying individuals at risk for IHD.

Overall, these findings underscore the importance of accurate risk assessment in identifying individuals at higher risk for cardiovascular events, particularly in the context of predicting IHD. Further research and validation are warranted to refine risk prediction models and enhance their clinical utility in cardiovascular risk management, with a focus on improving the accuracy of risk prediction for IHD.

Conclusion :

In conclusion, this study provides valuable insights into the assessment of the ASCVD risk calculator's validity in predicting ischemic heart disease (IHD) among patients undergoing characterization. The analysis revealed significant associations between various cardiovascular risk factors and the ASCVD risk score, particularly in the context of predicting IHD.

The findings emphasize the importance of accurate risk assessment and targeted interventions in managing cardiovascular risk among patients undergoing characterization, with a focus on predicting IHD. By identifying individuals at higher risk for IHD, healthcare providers can implement personalized interventions to mitigate the progression of the disease and improve patient outcomes.

However, it's essential to acknowledge the limitations of this study, including the relatively small sample size and the single-center nature of the investigation. Future research endeavors should prioritize larger, multicenter studies to validate the findings and enhance the generalizability of the results. Additionally, longitudinal studies tracking patient outcomes post-characterization could provide valuable insights into the long-term efficacy of risk assessment tools in clinical practice, particularly in managing cardiovascular risk among patients undergoing characterization.

Overall, while this study contributes valuable insights into cardiovascular risk assessment in patients undergoing characterization, continued research efforts are warranted to optimize risk prediction models and improve patient outcomes in cardiovascular care, with a specific focus on enhancing the accuracy of risk prediction for IHD.

Recommendation :

Based on the comprehensive analysis conducted in this study, several recommendations emerge to enhance the clinical management and outcomes of patients undergoing characterization:

1. Validation and Refinement of Risk Assessment Tools: Given the significant correlations identified between cardiovascular risk factors and the ASCVD risk score, it is imperative to conduct further validation

studies to assess the effectiveness and accuracy of existing risk calculators. Collaboration with experts in cardiovascular medicine and biostatistics can aid in refining these tools to better predict ischemic heart disease risk among patients undergoing characterization.

2. Integration of Risk Assessment into Clinical Practice: Advocate for the integration of validated risk assessment tools, such as the ASCVD risk calculator, into routine clinical practice. This can facilitate personalized risk assessment, informed decision-making, and targeted interventions to mitigate cardiovascular risk and improve patient outcomes.

3. Patient Education and Empowerment: Develop educational materials and awareness campaigns targeting both healthcare providers and patients to promote the importance of cardiovascular risk assessment and preventive strategies. Empowering patients with knowledge about modifiable risk factors and lifestyle modifications can encourage active engagement in their cardiovascular health and facilitate adherence to medical treatments.

4. Continued Research Efforts:Encourage ongoing research endeavors to optimize risk prediction models and explore novel biomarkers, imaging modalities, and predictive algorithms. Longitudinal studies tracking patient outcomes post-characterization can provide valuable insights into the long-term efficacy of risk assessment tools in clinical practice and inform the development of targeted interventions to improve cardiovascular care.

5. For patients undergoing catheterization, doctors may recommend lifestyle changes and medications to manage ischemic heart disease and reduce complications. These include:

- Adopting a heart-healthy diet.
- Improving sleep quality.
- Increasing physical activity.
- Losing weight.
- Managing stress.
- Participating in cardiac rehabilitation.
- Quitting smoking.
- Limiting alcohol intake.

6. To facilitate optimal and prompt recovery following the procedure, patients should adhere to the following recommendations:

- -Hydration: Drink plenty of liquids to clear the contrast material from your body. Increased urination is normal.
- -Bed Rest: If on bed rest, utilize a bedpan or urinal as necessary. Your provider will determine if you can return home or need overnight observation, monitoring you for several hours post-procedure.
- -Activity Limitations: Avoid strenuous activities (including sports and lifting) for two to five days, depending on catheter placement. Your healthcare provider will advise on returning to work. Refrain from submerging the puncture site in water for one week, including baths or swimming. Showering is permitted 24 hours post-procedure.

7. To address elevated blood pressure, consider:

Manage Blood Pressure: Promote optimal control through lifestyle changes and medications.
Reduce Cardiovascular Risks: Address modifiable factors like smoking, cholesterol, and diabetes.
Optimize Medications: Ensure prescribed drugs are suitable, adjusting as needed.
Schedule Regular Follow-up: Monitor blood pressure and adjust treatment plans accordingly.

8. Finally, For cardiac catheterization procedures, ensure:

- Thorough Preparation: Execute steps to enhance safety and reduce complications.
- Obtain Informed Consent: Disclose trainee presence and discuss do-not-resuscitate status if needed.
- Preprocedural Assessment: Conduct tests and assess bleeding risk for proper site selection.
- Medication Review: Ensure clear instructions on withholding medications, especially anticoagulants, to minimize bleeding risk.

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