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Translating Real-World Health System Strengthening Data into Long-Term Cardiovascular Outcomes: A Modeling Framework from Vietnam

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KEY FINDINGS AND CONCLUSIONS

- **From implementation to investment evidence:** The framework demonstrates how real-world HSS metrics can be translated into long-term outcomes to inform policy-making, funding and scale-up decisions of healthcare system interventions for policy-makers and program funders.
- **Meaningful projected health gains:** Observed improvements in treatment initiation and disease control were projected to avert 588 cardiovascular events and 315 cardiovascular deaths, while preventing 3,977 DALYs over 10 years.
- **Attractive return on investment profile:** The program was projected to generate 6,160 additional QALYs at an incremental cost of $9 million due to more patients being linked to treatment, resulting in an ICER of $1,477/QALY, below the modelled threshold of $14,637/QALY.

INTRODUCTION

- **Growing burden**: Low- and middle-income countries (LMICs) face a growing burden of non-communicable diseases (NCDs), such as cardiovascular disease (CVD).[1,2]
- **Evidence gap:** Health system strengthening (HSS) programs addressing this burden commonly report activities (e.g., number of people screened) and reach but rarely quantify long-term patient outcomes or economic value.
- **Action need:** Translating implementation data into outcomes can provide policymakers and funders with more actionable evidence.

PRIMARY AIM

To develop and apply an outcome-focused economic modelling framework that translates real-world HSS program data into projected long-term health and economic outcomes, using the Cùng Sống Khỏe (CSK) program in rural Vietnam as a case study.

BACKGROUND

CSK Program in Vietnam: focus areas

Cùng Sống Khỏe (CSK) is a long-standing HSS program (2012-today) implemented in rural Vietnam through a partnership between the Vietnamese Ministry of Health and Novartis.

In 2024–2025, CSK strengthened community screening, referral and linkage to primary care, provider capability, treatment initiation, patient follow-up, and support for sustained disease control.[3]

CSK Program metrics (2024-25):

Cross-sectional post-CSK metrics over 5.9 months[a] were compared with a scaled pre-CSK baseline. CSK screened 117,787 more people, linked 8,877 additional patients to treatment before adjustment for comorbidities, and improved hypertension and diabetes control rates.[b,c]

METHODS

A health economic model linked real-world CSK program metrics to long-term health and cost outcomes.

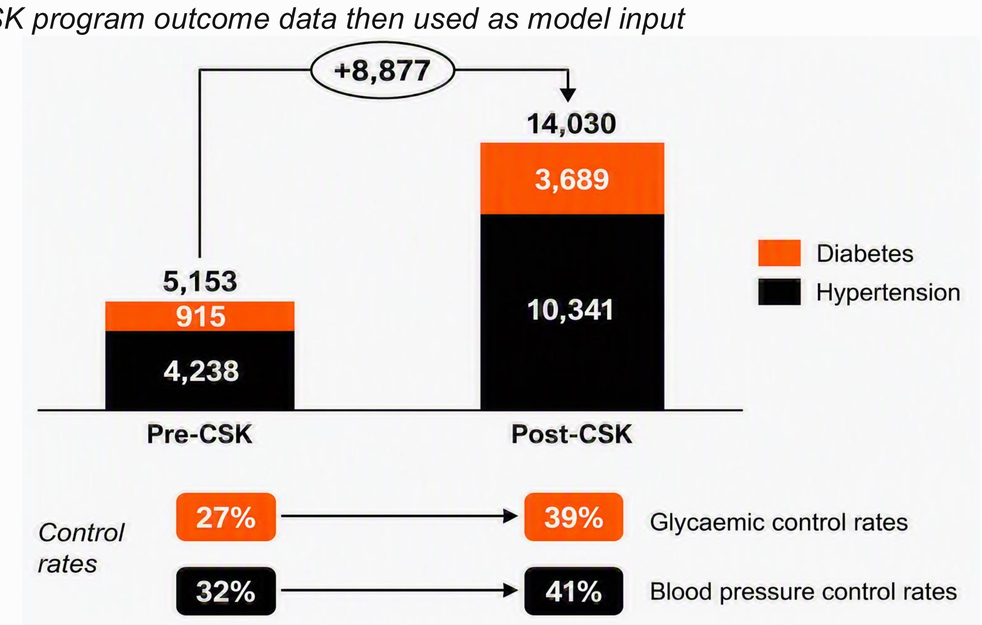
Modelling: CSK program metrics such as changes in treatment initiation and control rates were used to inform model parameters and incorporated into disease-specific Markov models, with outcomes aggregated over a 10-year horizon.[d]

Outcomes: Cardiovascular events, cardiovascular deaths, DALYs, QALYs, healthcare costs, and the incremental cost-effectiveness ratio (ICER).[d]

Key assumptions:

- Observed treatment-initiation and control-rate differences were extrapolated over 10 years.
- Patients remained in their initial controlled or uncontrolled state throughout the model horizon.
- Comorbidity adjustments were applied to reduce risk of double counting across condition-specific models.

Number of new patients linked to treatment
CSK program outcome data then used as model input



RESULTS

Observed improvements in treatment initiation and disease control were translated into projected 10-year health and economic outcomes.

- **315** Cardiovascular deaths avoided — 13.9% reduction
- **3977** DALYs averted — 6.6% reduction
- **588** Cardiovascular events[e] avoided — 7.4% reduction
- **$1477** ICER per QALY gained — vs $14,637/QALY threshold

Projected health gains at a cost below the applied willingness-to-pay threshold

LIMITATIONS

- Pre- and post-CSK data were cross-sectional rather than longitudinal; baseline activity was scaled to match the 5.9-month post-CSK period.
- Treatment-initiation and control-rate differences were extrapolated over 10 years without waning.
- Comorbid patients were allocated to one disease model, potentially omitting some additional costs and health risks.

References

1. Cardiovascular disease (CVD) in Viet Nam. (n.d.). World Health Organization.
2. Nguyen, Q. et al. (2012). Cardiovascular disease risk factor patterns and their implications for intervention strategies in Vietnam. *International Journal of Hypertension.* DOI: https://doi.org/10.1155/2012/560397
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Footnotes

a. The post CSK period was 5.9 months. The pre-CSK period was longer but was scaled to 5.9 months to ensure like-for-like comparison.
b. Hypertension control was defined as systolic blood pressure (BP) below 130 mmHg for those under 65 years old and below 140 mmHg for those 65 or over and as diastolic BP between 70-80 mmHg. Blood glucose control was defined as fasting plasma glucose before eating under 7.0 mmol/L.
c. The Vietnamese Ministry of Health modified the official definition of hypertension and diabetes control during the post-CSK period. Therefore, we adjusted officially reported post-control rates, using pre-control rate definitions to ensure like-for-like comparison.
d. Upcoming manuscript will further detail methodology, including the sensitivity analysis and additional sub-models, and including dyslipidemia and heart failure.
e. Cardiovascular events events included both fatal and non-fatal events.