# ทัศนคติต่อวัคซีนชีวสังเคราะห์ของคนไทยช่วงอายุ 15-60 ปี

## Attitude toward Synthetic Biology Vaccine among Thai people Aged 15-60 years

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## บทคัดย่อ

ชีววิทยาสังเคราะห์ (Synthetic Biology) มีบทบาทสำคัญในการพัฒนาวัคซีนยุคใหม่ โดยเฉพาะวัคซีนชนิด mRNA ที่สามารถผลิตได้อย่างรวดเร็ว มีความปลอดภัยสูง และตอบสนองต่อโรคระบาดที่เปลี่ยนแปลงอย่างรวดเร็ว อย่างไรก็ตาม การยอมรับวัคซีนที่พัฒนาจากเทคโนโลยีชีววิทยาสังเคราะห์ในกลุ่มประชาชนไทยยังคงมีข้อจำกัด เนื่องจากความรู้ที่ไม่เพียงพอ ความกังวลด้านความปลอดภัย และปัจจัยทางสังคมวัฒนธรรม งานวิจัยนี้จึงมีวัตถุประสงค์เพื่อประเมินระดับความรู้ของประชาชนไทยอายุระหว่าง 15-60 ปี เกี่ยวกับวัคซีนชีววิทยาสังเคราะห์ ศึกษาทัศนคติที่มีต่อการยอมรับวัคซีน

และวิเคราะห์ปัจจัยที่สามารถทำนายความเต็มใจในการรับวัคซีนดังกล่าว โดยใช้วิธีการวิจัยเชิงสำรวจแบบภาคตัดขวาง เก็บข้อมูลผ่านแบบสอบถามออนไลน์จากกลุ่มตัวอย่างจำนวน 894 คน ในช่วงเดือนมกราคมถึงกุมภาพันธ์ พ.ศ. 2568 และวิเคราะห์ข้อมูลด้วยสถิติเชิงพรรณนาและการวิเคราะห์ถดถอยพหุคูณ

ผลการวิจัยพบว่า ผู้ตอบแบบสอบถามส่วนใหญ่ ร้อยละ 66.33 มีระดับความรู้ต่ำเกี่ยวกับวัคซีนชีววิทยาสังเคราะห์ แต่กลับพบว่าร้อยละ 54.14 มีทัศนคติในระดับปานกลางต่อการยอมรับวัคซีน ปัจจัยความรู้มีความสัมพันธ์เชิงบวกกับการยอมรับวัคซีนอย่างมีนัยสำคัญทางสถิติ ($p < 0.001$) ในขณะที่เพศ อายุ รายได้ และระดับการศึกษาไม่มีนัยสำคัญ

จากผลการศึกษานี้สามารถสรุปได้ว่า แม้ประชาชนส่วนใหญ่จะมีความรู้เกี่ยวกับวัคซีนชีววิทยาสังเคราะห์ไม่สูงนัก แต่ก็ยังมีทัศนคติในเชิงบวกต่อการยอมรับวัคซีนในระดับหนึ่ง ซึ่งสะท้อนให้เห็นถึงบทบาทสำคัญของปัจจัยอื่นนอกเหนือจากความรู้เชิงวิชาการ เช่น ความไว้วางใจต่อแหล่งข้อมูล การสื่อสารที่เข้าใจง่าย และบริบททางสังคมวัฒนธรรม ดังนั้น การสื่อสารความเสี่ยงอย่างเหมาะสม ครอบคลุม และเข้าถึงง่ายจึงเป็นสิ่งจำเป็น เพื่อสร้างความเชื่อมั่นและเพิ่มการยอมรับเทคโนโลยีวัคซีนยุคใหม่ในประชาชนไทยอย่างยั่งยืน

**คำสำคัญ :** วัคซีนชีววิทยาสังเคราะห์, การยอมรับวัคซีน, ทัศนคติสาธารณะ, การสื่อสารด้านสุขภาพ, ความรู้เรื่องวัคซีน

## Abstract

Synthetic biology is revolutionizing vaccine development, particularly through innovations like mRNA-based vaccines that offer rapid production and strong safety profiles. Despite these advancements, public acceptance of synthetic biology-based vaccines remains uncertain in low- and middle-income countries such as Thailand, where awareness is limited and acceptance is influenced by skepticism and socio-cultural factors. This study aimed to evaluate the level of knowledge about synthetic biology vaccines among Thai individuals aged 15-60 years, explore their attitudes toward vaccine acceptance, and identify key predictors influencing their willingness to accept such vaccines. A cross-sectional online survey was conducted with 894 participants using purposive and snowball sampling methods. The questionnaire collected demographic data as well as responses related to knowledge and attitudes toward synthetic biology vaccines. Data were analyzed using descriptive statistics and multiple linear regression to explore associations and predictive factors.

The research results found that the most participants demonstrated low knowledge (66.33%), yet a majority (54.14%) held moderately positive attitudes toward synthetic biology vaccine acceptance. Knowledge was a significant predictor of acceptance ($p < 0.001$), while demographic variables such as gender, age, and income were not statistically significant. Discussion highlighted the role of external factors like trust and media exposure in shaping attitudes, despite limited scientific literacy.

From the results of this study, it can be concluded that public acceptance of synthetic biology vaccines in Thailand is moderately favorable, even with low awareness. This suggests that trust, effective communication, and cultural relevance may outweigh scientific knowledge in driving vaccine attitudes. Tailored outreach strategies are essential for promoting acceptance of emerging biotechnologies.

Keywords : Synthetic biology, vaccine acceptance, public perception, health communication, knowledge-attitude gap

## Background

In recent years, synthetic biology has emerged as a transformative field in biotechnology and medicine, enabling the rapid development of novel vaccine platforms. By integrating engineering principles into biological systems, synthetic biology allows scientists to design vaccines that are faster to produce, more adaptable, and potentially safer than traditional formulations. One of the most notable examples is the development of mRNA vaccines during the COVID-19 pandemic, which highlighted the scalability and responsiveness of this approach.[1-2] As synthetic biology advances, its applications in vaccine development continue to expand, with the potential to address complex and rapidly evolving diseases such as influenza, malaria, and emerging zoonotic viruses.[3]

Despite its promise, public perception and acceptance of synthetic biology vaccines remain uncertain. Studies from various countries have shown significant gaps in public knowledge and mixed attitudes, driven by concerns over safety, ethical implications, and the perceived novelty of the technology.[4-5] In Thailand, where biotechnology literacy remains limited among the general public, understanding these perceptions is critical for shaping effective public health strategies. Previous research indicates that vaccine acceptance is

influenced by factors such as knowledge, trust in scientific authorities, exposure to misinformation, and demographic variables including age, education, and income levels.[6-7]

While many international studies have focused on specific subgroups, such as students or healthcare workers, there is a lack of comprehensive research examining the general public's attitude toward synthetic biology vaccines in Thailand. Moreover, existing studies often concentrate on younger demographics, leaving a gap in understanding attitudes among broader age groups.

## Research Gap and Justification

Few studies in Thailand have addressed synthetic biology vaccine acceptance across a diverse population aged 15-60 years. Most available literature has targeted youth or urban populations without exploring generational differences or the impact of varying socio-economic backgrounds. This study fills that gap by examining how Thai individuals from different age and income groups perceive synthetic biology vaccines, and what factors shape their attitudes.

This research is timely and necessary. As synthetic biology-based vaccines move from clinical trials to public rollout, understanding public acceptance is essential to ensuring successful immunization campaigns. Misinformation, safety concerns, and knowledge deficits can undermine these efforts. Addressing these issues requires evidence-based insights into the public's readiness to embrace new vaccine technologies.

## Significance of the Study

The findings of this study will support policymakers, educators, and healthcare professionals in crafting tailored communication strategies to promote trust and acceptance of synthetic biology vaccines. It also contributes to the limited body of literature on public attitudes toward emerging vaccine technologies in Southeast Asia, helping bridge the gap between biomedical innovation and community health behavior.

## Objectives

This study aims to:

1. Assess the level of knowledge about synthetic biology vaccines among Thai people aged 15-60.
2. Study attitudes toward acceptance of synthetic biology vaccines in this population.
3. Identify demographic and knowledge-related predictors of vaccine acceptance.

## Methodology

This study employed a cross-sectional quantitative design using an online questionnaire to collect data from Thai individuals aged 15-60 years. The data collection took place between January 20 and February 20, 2025.

## Sample Selection

The target population consisted of Thai residents aged 15 to 60 years with internet access. Given the unknown population size, the sample size was calculated using Cochran's formula,[8] yielding a minimum requirement of 367 participants. However, the final sample included 894 respondents who voluntarily completed the survey. Participants were recruited through purposive and snowball sampling via social media platforms (e.g., Facebook, LINE), enabling access to a wide demographic range across urban and semi-urban regions. Eligibility criteria included being within the age range, residing in Thailand, and providing informed consent to participate.

## Data Collection Procedures

Data were collected anonymously using a self-administered Google Form. The form included a preamble explaining the study objectives, confidentiality assurances, and voluntary nature of participation. Out of 1,050 people who accessed the form, 894 completed it, resulting in a response rate of approximately 85.1%.

## Instrument Development

The questionnaire was developed based on an extensive review of existing instruments and literature related to synthetic biology, vaccine technology, and health literacy from reputable sources including the WHO, CDC, and peer-reviewed articles published between 2019 and 2024. The instrument was reviewed for content validity by three experts in infectious diseases, virology, and biotechnology. The Item-Objective Congruence (IOC) index was 1.0 for all items, and the reliability testing produced a Cronbach's alpha of 0.75, indicating acceptable internal consistency.

The questionnaire consisted of three parts:

1. Demographic Information: Four questions on gender, age, educational level, and household income.

2. Knowledge Assessment: Fifteen multiple-choice questions with one correct answer each, assessing basic knowledge about synthetic biology vaccines. The scores were interpreted using percentage-based

criteria: scores of 80% and above were categorized as "good," 60-79% as "moderate," and below 60% as "low."

3. Attitude Assessment: Five Likert-scale items ranging from 1 (strongly disagree) to 5 (strongly agree), measuring participants' attitudes toward vaccine acceptance. Some items were reverse-coded. Interpretation criteria followed a similar percentage breakdown: scores of 80-100% were considered "positive attitude," 60-79% as "moderate," and below 60% as "negative."

## Data Analysis

Descriptive statistics (frequencies, percentages, means, standard deviations) were used to analyze demographic characteristics, knowledge scores, and attitude levels. Multiple linear regression was applied to identify predictors of vaccine acceptance, including independent variables such as age, gender, education, income, and knowledge scores. Statistical significance was set at $p < 0.05$. Results were presented in narrative and tabular form.

## Ethical Considerations

The study was conducted in compliance with ethical research standards. Participants were informed of their rights to refuse or withdraw at any time. Data confidentiality and anonymity were maintained throughout. No personally identifiable information was collected, and all responses were securely stored with access restricted to the research team.

## Results

The demographic characteristics of 894 participants are explained in Table 1. The majority of respondents were female, representing 64.32% of the total sample, while males accounted for 35.68%. Most participants were aged between 31 and 40 years (36.58%), followed by those aged 15-20 (19.46%), 41-50 (19.35%), 21-30 (14.99%), and the smallest group aged 51-60 (9.62%). Regarding education, over half of the participants (54.14%) had attained a bachelor's degree, whereas 23.71% had completed high school, 18.79% held a master's degree, and only 3.36% had a Ph.D. Concerning monthly household income, the largest group earned between 40,001-80,000 Thai Baht (23.49%), closely followed by those earning 20,001-40,000 Baht (22.37%) and 80,001-150,000 Baht (20.81%). Participants earning over 150,000 Baht accounted for 20.47%, and the lowest income group, earning less than 20,000 Baht, comprised 12.86% of respondents.

Table 3. Demographic characteristics of participants (n=894)

| Variable | n (%) |
|---|---|
| **Gender** | |
| Male | 319 (35.68) |
| Female | 575 (64.32) |
| **Age (years)** | |
| 15-20 | 174 (19.46) |
| 21-30 | 134 (14.99) |
| 31-40 | 327 (36.58) |
| 41-50 | 173 (19.35) |
| 51-60 | 86 (9.62) |
| **Highest Educational Attainment** | |
| High school | 212 (23.71) |
| Bachelor Degree | 484 (54.14) |
| Master Degree | 168 (18.79) |
| Ph.D. | 30 (3.36) |
| **Monthly Household Income (Baht)** | |
| <20,000 | 115 (12.86) |
| 20,001-40,000 | 200 (22.37) |
| 40,001-80,000 | 210 (23.49) |
| 80,001-150,000 | 186 (20.81) |
| >150,000 | 183 (20.47) |
| Total | 894 |

Out of 894 participants, more than 50% of them scored lower than 9, identifying that the interpretation about Synthetic Biology Vaccine is quite poor in many people. Following up at the moderate level score between 9 to 11 points, the result points out that 22.6% of people interpret fairly. Lastly, 11.07% of the participants scored at the range of 12 to 15, concluding the result as a good interpretation.

Table 4. Synthetic Biology Vaccine Knowledge scores among participants (n=894)

| Score range | n (%) | Interpretation |
|---|---|---|
| 12-15 | 99 (11.07) | Good |
| 9-11 | 202 (22.60) | Moderate |
| <9 | 593 (66.33) | Low |

Overall, 302 out of 894 participants (33.78%) scored between 20-25, demonstrating good knowledge about the attitude towards the 'Acceptance of Synthetic Biology Vaccine.' However, around half of the total participants (54.14%, 484 participants) scored an average of around 15-19, while 108 participants (12.08%) scored below 15, indicating their lack of knowledge towards Acceptance of Synthetic Biology Vaccines.

Table 5. Attitude toward Acceptance of Synthetic Biology Vaccine (n=894)

| Score range | n (%) | Interpretation |
|---|---|---|
| 20-25 | 302 (33.78) | Good |
| 15-19 | 484 (54.14) | Moderate |
| <15 | 108 (12.08) | Low |

The linear regression analysis identified five significant predictors of attitude toward acceptance of synthetic biology vaccines. Knowledge ($B = 0.252$, $p < 0.001$) was the strongest predictor, showing a clear link between higher knowledge and attitude toward acceptance of synthetic biology vaccines. (Table 6.)

Table 6. Analyze predictive factors for Attitude toward Acceptance of Synthetic Biology Vaccine (n=894)

| Variable | B | Std. Error | Beta | t | Sig. |
|---|---|---|---|---|---|
| Gender | -0.141 | 0.244 | -0.019 | -0.578 | 0.564 |
| Age | -0.224 | 0.114 | -0.076 | -1.965 | 0.050 |
| Education Attainment | 0.257 | 0.192 | 0.053 | 1.338 | 0.181 |
| Household Income | -0.085 | 0.091 | -0.031 | -0.929 | 0.353 |
| Knowledge about Synthetic Biology Vaccine | 0.241 | 0.031 | 0.252 | 7.704 | 0.000 |

## Discussion

This study examined the level of knowledge, attitudes, and predictors influencing the acceptance of synthetic biology vaccines among Thai people aged 15 to 60 years. The results indicate that while a majority of participants demonstrated low knowledge (66.33%), more than half (54.14%) exhibited moderate attitudes toward vaccine acceptance. This finding reveals a notable disconnect between knowledge and attitude, suggesting that individuals may support or accept synthetic biology vaccines even without comprehensive understanding.

One possible explanation for this pattern lies in the broader influence of media coverage and public discourse during the COVID-19 pandemic. The rapid deployment and effectiveness of mRNA vaccines increased public exposure to synthetic biology technologies, fostering a sense of familiarity or trust even in the absence of deep scientific literacy. Similar trends have been observed in global studies, where acceptance of COVID-19 vaccines was not always contingent upon high levels of technical knowledge but rather on perceptions of urgency, collective responsibility, and trust in health authorities.[4-5,7] This finding also highlights the complexity of public attitudes, which are shaped not only by knowledge but also by cultural, emotional, and contextual factors. Attitude formation may be influenced by perceived benefits, societal norms, peer behaviors, and communication from trusted figures, all of which can moderate the impact of knowledge gaps. Therefore, while increasing public knowledge remains critical,

it must be complemented by strategies that address emotional concerns and foster trust.

Regression analysis further confirmed that knowledge is a significant predictor of vaccine acceptance ($p < 0.001$), while demographic variables such as gender, age, income, and education level were not statistically significant. This diverges from some prior studies that identified demographic disparities in vaccine hesitancy.[6-7] suggesting that in the case of synthetic biology vaccines, individual understanding may play a more central role than structural characteristics.

However, these results should be interpreted with caution. The sample was predominantly female (64.32%), which could introduce bias, as studies have shown women may exhibit higher vaccine hesitancy due to greater health risk sensitivity or differing information processing strategies. Additionally, the distribution of income groups in the sample was uneven. For instance, 23.49% of participants reported incomes between 40,001-80,000 THB, while only 12.86% earned below 20,000 THB. These proportions may not accurately reflect national income distributions, potentially limiting the generalizability of findings.

Moreover, the lack of statistical significance in demographic predictors contrasts with findings from other research that identified gender and income as important determinants of vaccine attitudes. It is possible that other unmeasured confounding variables-such as political beliefs, exposure to specific information channels, or prior vaccination experiences-could explain the variance in vaccine acceptance better than basic demographic factors alone. Future studies should consider including such variables and using stratified sampling to ensure demographic representativeness.

The findings are consistent with Pauwels, who found low public awareness of synthetic biology despite growing application in healthcare.[6] Other international studies echo this trend, showing moderate vaccine acceptance even in populations unfamiliar with the underlying science.[5] This implies that timely and transparent communication-rather than technical instruction alone-can significantly influence acceptance.

## Limitations

Several limitations must be acknowledged. First, the use of an online questionnaire may have excluded individuals without internet access, limiting the generalizability of findings to urban and digitally literate populations. Second, the study employed a cross-sectional design, preventing causal inferences or tracking of changing attitudes over time. Third, self-selection bias may have occurred, as individuals with an interest in health topics may have been more inclined to participate. Fourth, while the knowledge instrument showed acceptable reliability, the limited number of attitude questions may not have captured the full nuance of public perception. Fifth, gender imbalance and income distribution skew in the sample could have influenced the results, particularly regarding demographic predictors.

## Conclusion

This study provides evidence that knowledge is a key driver of vaccine acceptance among Thai people when it comes to synthetic biology technologies. While awareness remains low, public attitudes appear moderately favorable, likely influenced by broader social and communicative factors. These findings emphasized the need for integrated strategies that combine educational content with empathetic and culturally sensitive outreach to build confidence in synthetic biology innovations.

## แนะนำการอ้างอิงสำหรับบทความนี้

กานต์พิชชา แก้วของแก้ว, พรกนก พุฒพิสุทธิ์, จิรายุ ปราณปรีชากุล, อิงค์ฟ้า รองเรืองกุล, อรรจกร หวลเจริญทนต์, ฐิติชญาน์ เหมะรักษ์, และคณะ. ทัศนคติต่อวัคซีนชีวสังเคราะห์ของคนไทยช่วงอายุ 15-60 ปี. วารสารสถาบันป้องกันควบคุมโรคเขตเมือง. 2568;10(2):87-98.

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