

## Review Article

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# Risk Communication Strategies for Bt-based Public Health Interventions

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**Abstract** Bt-based public health interventions represent a significant advancement in disease control and vector management, leveraging the biological insecticidal properties of *Bacillus thuringiensis* (Bt). This study aims to analyze the risk communication strategies employed in Bt-based public health initiatives. We explore the principles and mechanisms of Bt interventions and set forth the objectives of this study to enhance public understanding and acceptance. Theoretical frameworks underpinning risk communication are discussed, encompassing key concepts, models, and ethical considerations. We detail strategies for identifying target audiences, crafting effective messages, and addressing public misconceptions. Through case studies of successful Bt interventions, we identify best practices and common challenges in risk communication. The review evaluates the effectiveness of these strategies using various metrics and emphasizes the need for continuous feedback and improvement. Finally, we discuss the implications for integrating risk communication into public health planning, offer policy recommendations, and propose future research directions. Effective risk communication is crucial for the success of Bt-based interventions, ensuring public trust and cooperation, ultimately contributing to improved public health outcomes.

**Keywords** Bt-based interventions; Risk communication; Public health; Vector management; *Bacillus thuringiensis*

## 1 Introduction

*Bacillus thuringiensis* (Bt) is a Gram-positive bacterium widely recognized for its insecticidal properties, particularly against dipteran insects, which include many vectors of human diseases such as mosquitoes (Zhou et al., 2020). The use of Bt-based interventions in public health has gained significant attention due to their effectiveness and environmental safety.

Bt-based interventions have been employed in various public health initiatives to control mosquito populations, which are vectors for diseases such as malaria, dengue, and Zika virus. The bacterium produces  $\delta$ -endotoxins during its sporulation phase, which are highly toxic to insect larvae upon ingestion (Raymond et al., 2010), leading to their death (Nair et al., 2020). Bt subsp. israelensis (Bti) is particularly effective against mosquito larvae and has been used in community-based larval source management (LSM) programs to reduce mosquito populations and, consequently, the incidence of mosquito-borne diseases (Ingabire et al., 2017).

The primary mechanism of Bt's insecticidal action involves the production of Cry and Cyt proteins, which form crystalline inclusions during sporulation (Ralte et al., 2012). These proteins are ingested by insect larvae, where they bind to specific receptors in the gut, causing cell lysis and death (Sanchis and Bourguet, 2011; Zhang et al., 2021). Bt-based bioinsecticides are considered environmentally friendly as they specifically target insect larvae without harming non-target organisms, including humans and other animals (Sanchis, 2011; Mendoza-Almanza et al., 2020). The effectiveness of Bt interventions can be influenced by factors such as the strain of Bt used, the method of application, and environmental conditions (Patil et al., 2011).

The objectives of this study are to examine the current state of Bt-based public health interventions, identify the key challenges and barriers to their implementation, and propose effective risk communication strategies to enhance community acceptance and participation. By synthesizing findings from various studies, this study aims to provide a comprehensive understanding of the socio-economic and operational factors that influence the success of Bt interventions and offer recommendations for future scale-up and integration into public health policies.