

REVIEW

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# Nanovaccines to combat drug resistance: the next-generation immunisation

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## Abstract

**Background** The present review envisages the role of nanovaccines to combat the global challenges of antimicrobial resistance. Nanovaccines are a novel formulation comprised of nanomaterials coupled with an immuno-genic component to elicit the immune response and provide protection against the desired infectious disease. The nanovaccines with unique physicochemical properties can be more efficient against targeting the desired tissues in the body, aids in prolong circulation to promote antigen-presenting cells to act upon the target antigens.

**Main content** The present review envisages the development of nanovaccines against antimicrobial-resistant pathogens. The use of nanovaccines can exhibit potent antigenicity with prolonged retention and controlled release to induce both cell- and antibody-mediated responses. Nanovaccines usage is still in the early stages and can be next-generation immunisation for prophylactic and therapeutic efficiency. The future development of nanovaccines against multi-drug-resistant pathogens can explore new avenues. Based on these facts, the present review is designed from the previously reported scientific studies and compiled with the fact that nanovaccines can revolutionise vaccine strategies. The articles were extracted from reputed databases like PubMed, Scopus, and ESCI. The size and conjugating chemistry of nanomaterials can be beneficial in developing novel multi-nanovaccine formulations that can target pools of antimicrobial resistance mechanisms.

**Conclusion** Overall, the nanovaccines can form one of the best effective modes of targeting multi-drug-resistant pathogens. The nanovaccines can stimulate the innate immune response and generate effective immune-therapeutic novel formulation against infectious pathogens. Based on these facts and considerations, the present article makes an alarming call to develop nanovaccines to counter multi-drug resistance.

**Keywords** Nanovaccines, Antimicrobial drug resistance, Nanomaterials, HIV, WHO

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## Background

There is growing evidence to confront the problem associated with antimicrobial resistance worldwide [1]. According to World Health Organization (WHO), by 2050 the menace of drug resistance is expected to magnify and cause highest mortality and morbidity rates [2]. The development of drug resistance has conquered all spheres of ecology by affecting both humans and other living species [3]. In the near future, it can have a huge impact and cause imbalances in the socio-economic sector. The impact is higher in developing and low-income countries owing to inadequate healthcare systems and poor sanitary facilities [4]. Drug-resistant pathogens can