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Review

A systematic review of serious video games used for vaccination

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ABSTRACT

Introduction: Vaccination is an effective and proven method of preventing infectious diseases. However, uptake has not been optimal with available vaccines partly due to vaccination hesitancy. Various public health approaches have adressed vaccination hesitancy. Serious video games involving vaccination may represent an innovative public health approach. The aim of this study was to identify, describe, and review existing serious video games on vaccination.
Method: A systematic review was performed. Various databases were used to find data on vaccination-related serious video games published from January 1st 2000 to May 15th 2015. Data including featured medical and vaccination content, publication characteristics and games classification were collected for each identified serious game.
Results: Sixteen serious video games involved in vaccination were identified. All games were developed in high-income countries between 2003 and 2014. The majority of games were available online and were sponsored by educational/health institutions. All games were free of charge to users. Edugame was the most prevalent serious game subcategory. Twelve games were infectious disease-specific and the majority concerned influenza. The main objective of the games was disease control with a collective perspective. Utilization data was available for two games. Two games were formally evaluated.
Discussion: The use of serious video games for vaccination is an innovative tool for public health. Evaluation of vaccination related serious video games should be encouraged to demonstrate their efficacy and utility.

Contents

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1. Introduction

Vaccination is an effective and proven method of preventing infectious diseases [1]. In recent years, however, re-emergence of previously eliminated and controlled, vaccine-preventable diseases have arisen [2,3]. Increased vaccine hesitancy and reduced immunization confidence are two factors that may have contributed to this re-emergence [4,5].

Public health approaches targeting vaccine hesitancy have been developed from varying fields including social marketing [6]. Applied video games, also known as serious video games, have also emerged as an approach to address vaccination concerns.

Serious video games (SVG) are digital games applied to train and educate users and are not primarily intended for entertainment purposes [7]. Since 2002, an increase in SVG production has been observed in military defense, education, corporate and health sectors [8]. Over one hundred SVG have been created in the healthcare sector alone, primarily focusing on physical activity, rehabilitation, cognitive stimulation, surgery, or emergency care for both patients and healthcare professionals [9,10]. To date, however, no review research has been made on SVG relating to vaccination [11,12].

The objective of this study was to identify, describe and compare all existing serious video games relating to vaccination.

2. Method

A systematic review was conducted using the databases PubMed, ScienceDirect, and IEEE Xplore (computer sciences database). Inclusion criteria included the description of SVG corresponding to the definition of "serious video game" [7] and content related to vaccines and vaccination. Studies in English or French and published from January 1st 2000 to May 15th 2015 were included. Further games were researched from manual searches of references, Google Scholar and Google search engine from May 6th to 15th, 2015. Additional information on games was obtained through searches for the specific name of each game with the input from the identified game developers and editors.

The search strategy was built using a combination of keywords for the serious video game and vaccination topics. Keywords were combined with the "OR" operator within each topic and the "AND" operator to link to the two topics. The keywords used with free terms or the use of Medical Subject Heading (MeSH) terms were "vaccine" or "vaccination" or "immunization" or "prevention" or "public health" or "infection" or each existing vaccines and vaccine preventable disease (VPD) or causal pathogen, and "video games" or "serious games" or "games". Identified studies were reviewed for eligibility by one author (OR) in a two-step process based on title and abstract screening and then full article retrieving. All types of studies were reviewed based on the scarcity of publication regarding SVG related to vaccination (see Fig. 1).

Data was extracted by one author (OR) using a standardized data extraction spreadsheet. The metadata collected for each identified SVG comprised of: game name, year of publication, country of development, language, access, financing, game subcategory, main core rules, public-targeted, disease specificity, disease-targeted, vaccination content, game objective and perspective, edition context and sponsors, data on utilization and evaluation. Subcategories and core rules were defined with the serious game classification tool from the website: serious.gameclassification.com [13,14]. According to the classification, a newsgame: a game broadcasting an informative message, an edugame: a game broadcasting an educative message, an exergame: a physical or cognitive training game, and an edumarketgame: a game broadcasting both a marketing or communication message and an informative or educative message. Vaccination content was classified into 3 categories from the perspective of vaccination: collective, individual and vaccine-pharmaceutical industry. Category assignment was created by three authors with disagreements resolved by consensus.

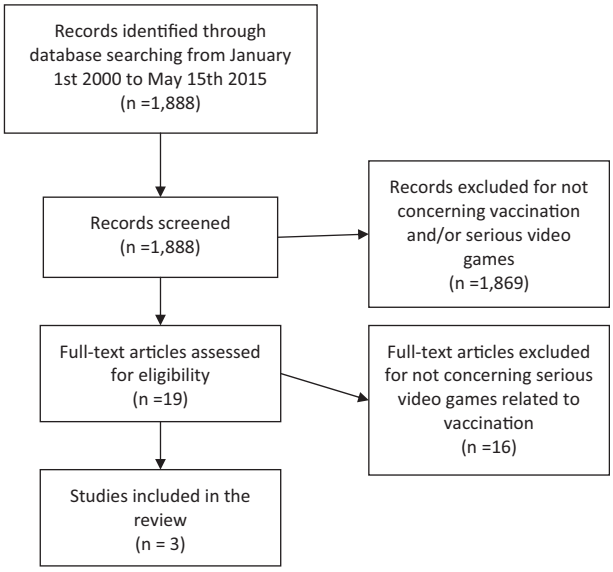

Fig. 1. Flow diagram of the systematic review on serious games and vaccination.

A descriptive analysis was performed to report the characteristics of the SVG and their relationship to vaccination. A detailed account of each game's design and informatics was outside the scope of the research.

3. Results

A total of 1888 records were identified resulting in 19 full text articles assessed for eligibility. Three studies were included in the review. In total, 16 vaccination related SVG were found with 3 reported in a published paper (Table 1). The first SVG was published in 2003 and the latest in 2014. The highest number of games published were in 2010 (5 games) and 2013 (5 games). All SVG were developed in high-income countries with the majority in France ($n = 7$) and USA ($n = 5$). Eight games were available in English (50%) and five were available in French (31.3%). The majority of games were available online (62.5%), followed by offline local access availability (18.8%), CD-ROM (12.5%) and mobile platform (6.3%).

All games were free of charge to users and were sponsored by international, state and regional level educational or health institutions (Table 2). Berna Biotech financed "Flu Shot" developed by Nothing Interactive [15] and Pfizer funded "Les Méningo – Smash Pursuit" developed by the Addiction Agency [16]. GlaxoSmithKline and Solvay Biologicals financially participated in "The Great Flu" game supported by Erasmus MC, Rotterdam [17]. Pfizer provided a grant in the development of the "Flu Busters!" game [18]. Agence de Médecine Préventive (AMP), a non-governmental French organization, partnered with the World Health Organization (WHO) to develop "SimSURVEA" [19] and the yellow fever epidemics investigation game [20].

Edugames were the most prevalent serious game subcategory (8 games). Exergames were developed for healthcare worker training in vaccination guidelines and did not address vaccine hesitancy. Newsgames focused on the influenza pandemic in the 2009–2010 season. The primary target was high school and college students (4 games), followed by healthcare workers (3 games) and