

Title

Design software Caarbon 3D-Prints Test Swabs, Face Shields to Help Relieve COVID-19 Shortages

Abstract

During the recent Covid-19 pandemic, additive Technology and Social Media were used to tackle the shortage of Personal Protective Equipment. A literature review and a social media listening software were employed to explore the number of the users referring to specific keywords related to 3D printing and PPE. Additionally, the QALY model was recruited to highlight the importance of the PPE usage. More than 7 billion users used the keyword covid or similar in the web while mainly Twitter and Facebook were used as a world platform for PPE designs distribution through individuals and more than 100 different 3D printable PPE designs were developed

Introduction

Coronavirus Disease 2019 (Covid-19) or SARS – CoV – 2 has already spread worldwide and affected more than 2.000.000 people, with almost 137.000 deaths, according to the Johns Hopkins University (April 16, 2020)

The case fatality range for the ages between 40 and 49 estimated at 0.4% and increased at 14.8% for the 80+ age range. The epidemiological statistics were similar for most cases with some notable exceptions, such as Italy which did not follow the general rule One of the most important

factors enabling the wide spread of COVID 19 is its very short diameter size, ranging between 60 and 140 nm, which renders the use of Personal Protective Equipment crucial for the protection of health professionals

On October 2014, the World Health Organization (WHO) updated the PPE instructions, suggesting the use of boot covers, inner and outer gloves, masks, face protectors, surgical hood coverall, outer apron and face shield . PPE is used as a shield between the health professionals and germs and must be used by the hospital staff during serious situations like a pandemic. PPE are one of the measures for the improvement of occupational health and safety Special care must be taken to avoid contamination at the disposal of it . PPE can generally be described as nonpharmaceutical barriers against the virus dissemination and one of the parameters accounted for in the Quality Adjusted Life Year (QALY) model . The QALY allows for the combined study of outcomes of any health-related actions and their effect on mortality into a single indicator, thus establishing a method that enables comparisons across multiple disease areas. At the same time, medical applications for 3D printing are expanding rapidly and are expected to revolutionize health care . The first 3D printers were invented from Hideo Kodama and Charles Hulls in the early 1980s Additive technology used in various sections such as the

Aerospace and Automotive industry, military, Sports field, architecture, toys industry and bioengineering with different benefits and disadvantages . Since then, different 3D printing methods have been used, based on extrusion, powder solidification and liquid solidification, with different types of materials as building materials The aim of the present article is to explore the relationship between social media and 3D printing, in the context of the recent Covid-19 pandemic. We will analyze which types of Personal Protective Equipment can be printed, and how the 3D printing users can be coordinated to achieve mass printing volumes.

Methods and materials

2.1. Overview

Two independent searches have been conducted, in order to examine the degree that social media has affected the development and dissemination of PPE and medical equipment parts. They explore how 3D printed designs were utilized to address the Covid-19 pandemic, as well how the QALY model can be applied in this case to measure the effects of the use of PPE. In the first in depth search, social media was studied using targeted keywords, while an official database was implemented and the QALY model was applied.

2.2. Social media and 3D printing of PPE

Since Covid – 19 appeared in the Wuhan district in China, several drawings of PPE were shared between social media users, 3D community and individual citizens. A specialized social media software (Awario) was recruited for gathering information about content which refers to Covid-19, 3D printing and PPE. Targeted queries were performed on popular social media such as

Facebook, Twitter, Instagram, YouTube, Reddit and also on News/Blogs and the Web in general.

2.3. PPE and QALY

There are two major parameters that have been studied, the life expectancy of health professionals and the average life expectancy until the death of someone who became ill with Covid - 19 which suggests that hygiene rules or Personal Protective Equipment have not been used or are being misused. Data on life expectancy were obtained from WHO and OECD, while the calculation of the average lifespan was researched in the scientific databases PubMed and Scopus with the keywords “Symptoms” AND “Death” AND “Covid” AND “Days” (GHO) data, World Health The results of the search were analyzed and summarized in the next section.

Conclusion

This study examined the way individual social media users and 3D printer owners tackle the PPE shortage during a pandemic. Social media influences the problem in multiple levels: Firstly, they highlight the problem, in this context the lack of PPEs, secondly they encourage and promote the formation of task forces/teams from the general population with a relevant interest, thirdly they provide the means for exchanging information and technology and finally they can identify the number of required 3D printers in a local, national, or even international level needed to achieve the task.

ADVANTAGES OF 3D PRINTING

1. SPEED

2. COST

3. FLEXIBILITY

4. COMPETITIVE ADVANTAGE

5. TANGIBLE DESIGN AND PRODUCT TESTING

6. QUALITY

7. CONSISTENCY

8. RISK REDUCTION

9.ACCESSIBILITY10. SUSTAINABILIT

Software requirement

1) Websites (PHP)

2) Android Application (JAVA)

KEY POINTS

COVID-19 has transformed 3-D printing, and , Shapeways and Carbon are rushing to rapidly produce much needed medical test equipment, and face masks during the coronavirus pandemic.

The rapid prototyping technology allows designs for a face mask part, even a coronavirus nasal testing swab to be pushed out to thousands of computers instantly.

To combat the medical equipment shortages caused by the coronavirus pandemic, Healthcare is using 3-D printing to make tools that accelerate ventilator production. space venture Blue Origin is leveraging 3-D printers to make plastic components for face shields. And with support from Adidas, digital manufacturing firm Carbon, in Silicon Valley, is using its highly elastic polymer featured in Adidas running shoes to produce more than face shields weekly for health-care workers caring for COVID-19 patients.

Reference .

“In Memoriam: Healthcare Workers Who Have Died of COVID-19,” Medscape, Apr. 15,2020.<https://www.medscape.com/viewarticle/927976> (accessed Apr. 15, 2020).

“Joint Statement on Multiple Patients Per Ventilator,” Americal Society of Anesthesiologists, Mar. 26, 2020. <https://www.asahq.org/about-asahq/newsroom/news-releases/2020/03/joint-statement-on-multiple-patients-per-ventilator> (accessed Apr. 02, 2020).

“Life expectancy,” Global Health Observatory (GHO) data, World Health Observatory, 2016. https://www.who.int/gho/mortality_burden_disease/life_tables/situation_trends/en/.

“Personal protective equipment,” World Health Organization, 2020. https://www.who.int/medical_devices/meddev_ppe/en/ (accessed Apr. 03, 2020).

Fig 1) 3D designs of PPE and parts of medical equipment

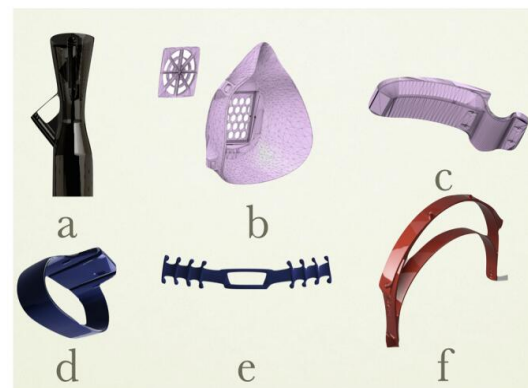
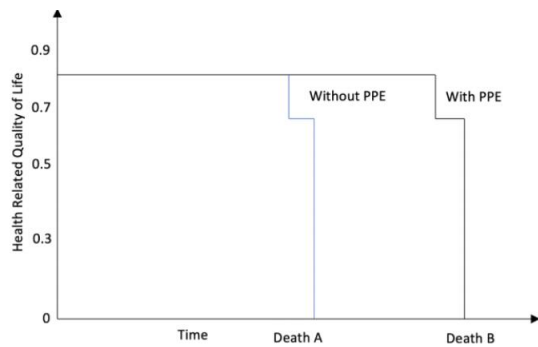


Fig 2) QALYs gained from using PPEs



Carbon's nasal testing swabs, fast-tracked to FDA approval, are made from Carbon's lattice design structures.

Fig 3) 3D PPE Printing flowchart

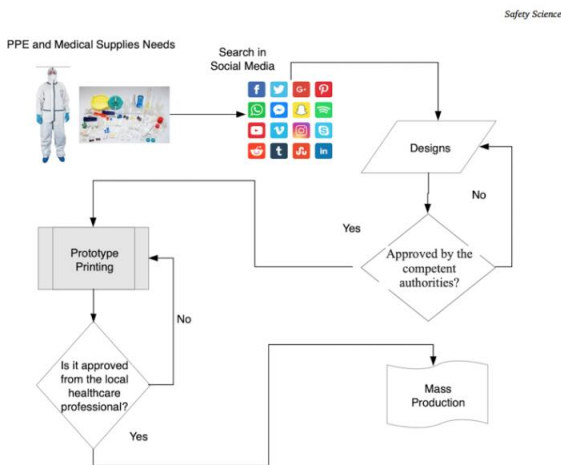
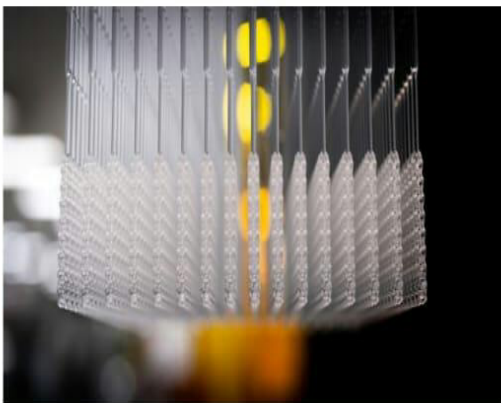


Fig 5) Face shields



Fig 4) Testing Swabs



3-D printing company Carbon has created midsoles for Adidas shoes, football helmet liners for Riddell. Now it will produce and ship up to face shields to help in the COVID-19 fight.

Group Members:

| Sr. No. RollNo. | Name |
|---------------------|---------------------|
| 1. 178 | Miss. Autade Nupur |
| 2. 179 | Miss. Gite Madhuri |
| 3. Pratiksha 170 | Miss. Chandanshiv |
| 4. 180 | Miss. Hambre Mayuri |