

Smart Innovation, Systems and Technologies

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Yen-Wei Chen · Satoshi Tanaka
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Innovation in Medicine and Healthcare 2017

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Conference on Innovation in Medicine
and Healthcare (KES-InMed 2017)

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Preface

The 5th KES International Conference on Innovation in Medicine and Healthcare (InMed-17) was held on June 21–23, 2017, in Algarve, Portugal, organized by KES International.

The InMed-17 is the 5th edition of the InMed series of conferences. The 1st, the 2nd, the 3rd, and the 4th InMed conferences were held in Italy, Spain, Japan, and Spain, respectively. The conference focuses on major trends and innovations in modern intelligent systems applied to medicine, surgery, healthcare, and the issues of an aging population including recent hot topics on artificial intelligence for medicine and healthcare. The purpose of the conference is to exchange the new ideas, new technologies, and current research results in these research fields.

We received submissions from more than 10 countries. All submissions were carefully reviewed by at least two reviewers of the International Program Committee. Finally, 31 papers were accepted to be presented in this proceeding. The major areas covered at the conference and presented in this proceedings include the following: (1) Biomedical Engineering, Trends, Research, and Technologies; (2) Machine learning and labeling for biomedical visual data analysis and understanding; (3) Advanced ICT for Medical and Healthcare; (4) Healthcare Support System; and (5) Smart Medical and Healthcare System. In addition to the accepted research papers, three keynote speeches by leading researchers were presented at the conference.

We would like to thank Dr. Kyoko Hasegawa and Ms Yuka Sato of Ritsumeikan University for their valuable editing assistance for this book. We are also grateful to the authors and reviewers for their contributions.

June 2017

Yen-Wei Chen
Satoshi Tanaka
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Prediction and Prevention of Addictions Through the Implementation of a Computational Social Simulator

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Abstract. The main objective of this work is to determine if a computer simulator can identify the interaction between risk factors and protective factors in relation to the emergence of substance use problems in a population of adolescents. This simulator will undoubtedly reduce time, while allowing statistics to be used to support public, private and social initiatives in order to make agile decisions in the area of health; by means of an accumulated knowledge base that is based on the experience related to research and support to the community affected or at risk of falling into the consumption of addictive substances. The prediction and prevention of addictions in Baja California and the population of Mexico in which it is used will be strengthened by this tool. The regulatory framework that establishes the prevention of addictions allows different strategies to strengthen and contribute to the Mexican government's work in the area of public health and addictions.

Keywords: Addictions · Social simulator · ICT

1 Introduction

1.1 Addictions

Addiction is a disorder, which by its manifestations can sometimes be used to justify postures, declarations, emphatic, sensed pronouncements. This disorder involves a complicated solution, which requires the articulation of different actions and from different aspects, beyond the medical-psychological treatment of the addicts. The factors that must be matched so that the disorder can arise as such are: personal factors such as genetics and personality, sociocultural factors such as symbolic value and social utility of consumption as well as the existence or not of healthy alternatives, average factors - environmental as the geographical position of a certain community and the availability of the substance or conduct and finally the pharmacological or addictive factors of a certain behavior or substance [1].

1.1.1 The Health Law

This law regulates the right to the protection of one's health, based on Article 4. Of the Political Constitution of the United States of Mexico and in general terms specifies the structure that will attend to and which competes for health in the aspect of addictions.

Article 13, paragraph C, states that: "It is the responsibility of the Federation and the federal entities to prevent narcotic use, care for addictions and prosecution of crimes against health...", for this purpose, in Title XII in section Against Addictions, contains Chap. 1 and establishes the creation of the National Council against Addictions, established in Article 184 Bis, which says "The National Council Against Addictions is created, which will aim to promote and support the actions of the Public, social and private sectors aimed at preventing and combating public health problems caused by Addictions..." [2].

1.1.2 CONADIC

The main objective and mission of the National Commission Against Addictions is to promote and protect the health of Mexicans through the definition and conduct of national policy in the areas of research, prevention, treatment, training and development of human resources that support the Control of addictions, with the purpose of improving the individual, family and social quality of life [3].

The mission of the National Commission Against Addictions CONADIC is aligned with the National Development Plan and the National Health Program, included in the Ministry of Health.

1.1.3 Addiction Care in Baja California, Mexico

Baja California was one of the first states in Mexico, which institutionalized attention to addictions in all its facets. Through the Institute of psychiatry of the state of Baja California that has a staff of professionals in the area of Health focused exclusively on prevention, training, control and treatment of Addictions. Strategies have been implemented that have demonstrated progress in this area.

The Baja California Congress has implemented the Safe and Healthy Families program, where one of the main actions is to focus on the issue of addictions, and to do this creates a model of interdisciplinary care, with people who are specialized and sensitive to such problems, to attend to all the family that lives the attacks and the sequels of this disease.

According to the WHO, addiction is a physical and psychoemotional illness, which creates a dependency or need for a substance, activity or relationship. Its origin is multifactorial, so that biological, genetic, psychological and social factors are involved.

The program safe and healthy family is committed to a new model "SECOYT" (Awareness, awareness and treatment) created by the team that heads the Deputy and president of the health commission Dr. Miguel Antonio Osuna Millán. The program's main responsibility is to provide psychological, medical and psychiatric care to the communities and schools of Tijuana, Baja California, Mexico, through primary, secondary and tertiary prevention. Another important model is the so-called "therapeutic community" where a therapeutic context is created for people with drug problems, that

is to say a residential context, where they coexist between them, and where the main objective is to achieve recovery through Abstinence, and psycho-emotional development that can provide you with the tools you need to stay sober for life.

To better explain what the SECOYT Model of Healthy and Safe Families Program wants to achieve with communities and schools, it is important to know the transteoric model of the Prochaska and Di Clemente Change. This is based on the basic premise that behavioral change is a process and that people have different levels of motivation, intention to change.

In order to achieve success in change, it is crucial to know in which stage the person is in relation to his problem, in order to design specific procedures that suit each subject, according to the Change Model (Fig. 1):

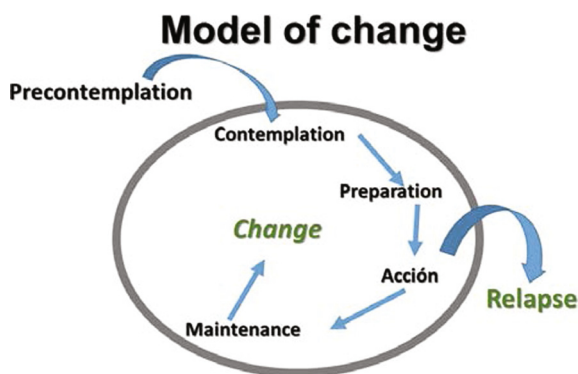


Fig. 1. Change model Prochaska and DiClemente [5–7].

Pre-contemplation: it is probable that the patient attends by external constraint (court order, relatives, etc.), expressing denial of the problem and without actually considering the change.

Contemplation: the subject recognizes having a problem, is more receptive to the information regarding their problem and possible solutions.

Preparation: at this stage the person is ready for the performance, having taken some steps towards the goal.

Action: refers to the moment when the steps taken to achieve change become more evident. Its duration is 6 months.

Maintenance: follows the action and lasts another 6 months, the purpose at this stage is to sustain the changes achieved through lifestyle modification and relapse prevention.

1.2 Behavior of the Population of Baja California, Mexico, in the Consumption of Psychoactive Substances

The State Observatory of Addictions (OAS) in the periods from 2004 to 2012, through studies conducted, observes the following pattern of behavior in the population in Baja California the prevalence of use of psychoactive substances: in 2004 there was a

prevalence at the state level of 25.90%, 2005 of 33.60%, 2006 with 50.8%, in 2007 was found 47.21%, in 2008 it was obtained 36.27%, 2009 36.67% while in 2010 41.42%, decreased in 2011 to 39.44% in 2006. The highest prevalence rate was found, indicating a period of decline in consumption towards the most recent years.

These studies reflect the range of chronological age in which they began to use drugs ranging from 6 to 48 years, being between 8 and 18 years of age the largest percentage of individuals who started to use substances, being 8.2% of The respondents. The average age of start of consumption of the respondents is of 14.8 years. As for the drug with which they began to use psychoactive substances, alcohol is first with 45.8%, followed by tobacco with 17.2%, marijuana with 14.3%, sedatives, inhalants and methamphetamine with 1.5% respectively, opiates 1.0%, and ecstasy, cocaine and hallucinogens with 0.5%, respectively; The rest of the percentage mention having started consumption with combinations being 3.9% for alcohol and tobacco, 1.0% alcohol and marijuana, and 0.5% for tobacco, methamphetamine, inhalable and cocaine, 0.5% marijuana and opiates, 0.5% inhalable, marijuana and other medical drugs, marijuana and alcohol 0.5%, and 8.9% did not answer.

Due to the patterns and results observed in the studies conducted by the OAS, it is observed that there is a complex social and health problem, so with the support of information technologies, a Social Simulator will be developed to predict and prevent the use of Harmful substances and generate addictions [1, 4, 8].

1.3 Proposal to Predict and Prevent Addictions Through a Computational Social Simulator

Social simulation is adequate for the analysis of social phenomena that are inherently complex. While the idea of simulation has had enormous influence in most areas of science, and even in game programming, where there is already an emulation of societies having a significant impact on the social sciences. The progress came when they realized that computer programs offer the possibility of artificially creating societies in which people and collective actors can be directly represented organizations and observe the effect of their interactions. This provided the possibility of using experimental methods with social phenomena, and the use of computer code as a way of formalizing social dynamical theories [2].

The creation of a simulator of learning processes for the prediction and prevention of addictions, contemplates the use of technology therefore uses innovation that is a complex process, uncertain, somewhat disordered, subject to changes of many types that underlies complex dynamics And multidimensional approaches that cover a variety of actors and domains of knowledge in an environment, so that the actors in the environment must improve their skills to properly handle emergent phenomena that arise.

The creation of a process simulation tool for prediction and prevention of addictions, means that the emerging behaviors and phenomena in this domain must be modeled so that users experience in a nonlinear way, these phenomena.

The realization of this simulator will facilitate the users that will attend to the problem, through a tool that helps to experience different approaches of the emergent

phenomena, in such a way that the corresponding planning and prevention for the control of addictions is developed.

1.4 Hypothesis

A computer-based social simulator can identify the interaction between risk factors and protective factors in relation to the emergence of substance use problems in a population of adolescents.

1.5 General Objective

Development of a computational social simulator for the prediction of risk factors and protective factors in relation to the appearance of substance use, problems in a population of adolescents from third year of secondary school in District X of the city of Tijuana, Baja California.

1.6 Specific Objectives

Identify prevalent risk factors of the study population.

Identify existing protective factors in the defined population.

Determine the correlation between risk factors and protective factors with substance use.

Establish the pattern of combination of risk factors and protective factors and the emergence of substance use problems.

Classify in relation to the presence of substance use in the population studied in risk groups.

Generate a computational tool that classifies the population into groups at risk.

Elaboration of the study of art on risk factors, protective factors, addiction and related elements.

Elaboration of computational modeling to determine factors associated with substance use.

Construction of a simulator that implements addiction processes.

Development of a social simulator for the prediction of addictions.

1.7 Justification

With the identification of risk factors and protective factors, the appropriate classification of groups, in high risk groups, moderate risk and low risk, may affect public health and provide the appropriate approach. The use of information and communication technologies have changed the way we do things, from an internet consultation to using technologies as work tools, are a necessity in the world in which we live. In the health area the changes that have been presented are many, to mention some from the storage of the information in medical records that allow the consultation of the information at all times until the accomplishment of surgical operations guided by technological

devices. This article presents an analysis of the characteristics of technological applications in the health area, namely the use of Big Data and the implementation of clinical records. It presents the basis of BigData, its features, its functions, and existing applications, as well as the creation of a BigData model the health sector in Mexico.

2 Background and Related Work

2.1 Studies that Determine Risk Factors and Protective Factors

Research has determined how drug abuse begins and how it progresses, and there are factors that can increase a person's risk for drug abuse. Risk factors can increase a person's chances of abusing drugs while protective factors can reduce this risk. It is important to note that most people who are at risk for drug abuse do not begin to use them or become addicted, in the same way what constitutes a risk factor for one person, may not be for another.

Risk and protective factors can affect children during different stages of their lives and in each of them, risk events occur that can be changed through a preventive intervention. If untreated, negative behaviors from an early age can lead to additional risks, such as academic failure and social difficulties, which increase children's risk for future drug abuse [8].

Risk factors can influence drug abuse in a number of ways. The more risks a child is exposed to, the more likely the child is to abuse drugs. Some of the risk factors may be more powerful than others during certain stages of development, such as peer pressure during the adolescent years; As well as some protective factors, such as strong bond between parents and children, they have a greater impact on reducing risks during the early years of childhood. An important goal of prevention is to change the balance between risk factors and protection factors so that protection factors exceed those at risk [8].

3 Research Development

3.1 Computational Social Simulator

Social simulation can contribute to the understanding of social processes; Or some kind of theory or model. In general, these theories are exposed in textual form, although sometimes the theory is represented like an equation; A third way is to express theories as computer programs. Social processes can be simulated on the computer. In some circumstances, it is even possible to conduct experiments on social systems artificially that would be totally impossible or unethical to carry out in human populations [10].

Each relationship with the model must be specified exactly and each parameter; Otherwise it will be impossible to execute the simulation. This discipline also implies that the model is potentially open to inspection by other researchers, in all its details. These benefits of clarity and accuracy also have disadvantages, however. Simulations of complex social processes involve estimating many for meters and adequate data to

make estimates that may be difficult to find. Another benefit of the simulation is that, in some circumstances, it can give ideas about the “appearance” of macro-level phenomena of micro-level actions. For example, a simulation of the interaction of individuals may reveal clear patterns of influence when examined on a societal scale [10].

Social simulation shows how this new methodology is adequate for the analysis of social phenomena that are inherently complex. While the idea of simulation has had enormous influence in most areas of science, and even in game programming, where there is already an emulation of societies having a significant impact on the social sciences. The breakthrough came when they realized that computer programs offer the possibility of artificially creating societies in which people and collective actors can be directly represented organizations and observe the effect of their interactions. This provided the possibility of using experimental methods with social phenomena, and the use of computer code as a way of formalizing social dynamic theories [11].

Real-world simulations including population as a target should include some means of validation. In econometrics, in political sciences and sociology data sets for verification are abundant. Other areas, mainly anthropologies suffer from a lack of data. The provision of these data are a secondary concern. The main difficulty in the datasets is appropriate to the architecture of the agent; An example of this are studies that focused mainly on the cognitive roots of social theory [12].

3.2 Methodology for Research and Development of the Tool

The methodology will be divided into two phases: The research methodology required to integrate information to form the knowledge base of the computational social simulator and the methodology required for the development of the computational social simulator.

Due to the objective and the characteristics that the research requires will be descriptive and correlational. Descriptive because it will identify psychoactive situations or facts for a diagnostic study of a social and correlational phenomenon because they will analyze the relationship or association of different variables in the study phenomenon.

The development of the research will be carried out in two stages:

- (1) The first one that aims to determine the risk factors and protective factors in adolescents in the consumption of substances that are in the third year of high school in the district X (11 high schools, 16 groups with 1983 adolescents) of the city of Tijuana Baja California.

At this stage the research will be carried out under the following phases [4, 9, 13, 14]:

- Preliminary research.

- Development conceptual framework.

- Definition of variables.

- Definition and selection of the sample.

- Analysis of the Posit data collection instrument. East

Instrument to use allows “Self-assessment to detect problematic areas of functioning in adolescents and that could increase the risk of consumption of psychoactive substances”.

Collection of data.

Analysis and interpretation of data.

Reporting of results for each period.

- (2) The second stage aims to develop the computer simulator. For the development of the computer simulator, the Scrum methodology will be implemented, it is the most optimal to work collaboratively in a team, and obtain the best possible result. This methodology makes partial and regular deliveries of the final product, prioritized by the benefit they bring to the receiver of the simulator. The phases presented are as follows [15].

Start

Planning and Estimation

Implementation

Review and Retrospective

Launching

4 Conclusions

The support of a social simulator oriented to the prediction and prevention of addictions or consumption of substances harmful to health, will create an advantage in detecting and following up the risk factors and protectors that are common in various case studies, they will feed The knowledge base of the computational social simulator and will allow to create levels of artificial intelligence that generate scenarios and strategies of support in diverse cases.

The use of a digital tool, the simulator as a classifier, risk stratifier and predictor of the probability that an evaluated patient, presents substance use, in the future is certainly a social support for a community at risk.

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