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STRATEGIES IN PRIMARY CARE TO TURN THE TIDE ON OBESITY

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The aim of this paper is to understand the background situation of obesity care and problems connected with obesity mainly at the very early stage, particularly in elderly subjects. The goal is to decrease Type 2 diabetes incidence and its chronic complications which may lead to dysfunctions (*e.g.*, fatal or non-fatal myocardial infarction, angina, heart failure and stroke). Specifically, the paper addresses the following questions:

- What are the fundamentals of obesity prevention?
- What are existing treatment models of overweight and obesity?

Based on the answers of the two questions, the paper tries to demonstrate the benefits of using social media of Web 2.0 technology and of Web 2.0 communities adopted and implemented in the health field to address obesity problems early. Development of patient-oriented services based on Cloud computing facilitates is expected to support patient empowerment, self-care, adherence to prevention plans and treatment and to turn the tide on obesity.

Keywords: Primary care; Obesity prevention; Obesity treatment; Physical activity; Advanced data analytics; Advanced ICT systems and services.

INTRODUCTION

Obesity and physical inactivity are emerging as an important public health problem that increases the risk of many health complications such as Type 2 diabetes, cardiovascular diseases (*e.g.*, hypertension, stroke and coronary heart disease), certain types of cancer and osteoarthritis[1].

Epidemiological studies demonstrate a clear link between obesity and increased risk of developing Type 2 diabetes (T2DM), although the cause is multifactorial and would include genetic, diet, lack of physical activity and other factors. Effective management of obesity is critical to reduce risk of developing T2DM and the risk of developing complications. The prevalence of diabetes for all age-groups worldwide is estimated to rise to 366 million in 2030[2]. However, this upper figure, although comprehensive in terms of prevalence, by definition it does not included people with undiagnosed diabetes. Most of overweight people, especially on a population predominantly older than 65 years, with pre-diabetes (impaired glucose tolerance), which is the most common cause of T2DM, are unaware of it.

Why we believe that it is possible to turn the tide on obesity? The Internet represents a golden opportunity: it is almost routine use nowadays and it facilitates data collection. The data collected aim to provide insight of the quality of health care process, to improve efficiency, and to identify the causes of problems that may appear during the obesity prevention and care process. In the digital world the data are very foundations of in terms of consumption of meat and vegetables, chemicals contents of food, vitamin and minerals contents, organic versus conventional food, nutritional content, answer to relevant questions about organic versus conventional food taste, etc.

To better understand status of healthcare is needed faster moving into advanced data analysis (*e.g.*, data analytics) through information inter-connectivity in the new era of the transformation of healthcare from a paper-based industry to a digital

industry. The BIRO technology[3], an innovative healthcare advanced analytics system is with the EU diabetes common data set[4] and digital healthcare information interconnectivity[5] one of the three main components that need to be integrated for ability to predict and determine best practices in primary care in terms of obesity, and also provide overall lower costs with better patient care. Therefore, this paper is based on an example of using Open Source BIRO technology for advanced data analysis aiming to deriving information about the overweight and obesity in newly diagnosed Type 2 diabetes context.

OBESITY PREVENTION

Nowadays is a perfect moment to highlights the key tasks general practitioners (GPs) may play to addressing coherently the prevention of obesity, expressed as weight in kilograms divided by height in meters squared (kg/m^2). The first and foremost question: what are the fundamentals of obesity prevention? Obesity prevention is mainly referring to:

1. Weight reduction to patients who are overweight;
2. Strategies to prevent progression to obesity among adults by lifestyle modification to regulate bodyweight with long term stability of BMI within 18.5 and 29.9 kg/m^2;
3. Recommend a specific strategy and provide resources for weight-loss maintenance to patients who are overweight (BMI $\geq$ 25 kg/m^2) or obese (BMI $\geq$ 30 kg/m^2) and morbidly obese adults (BMI $\geq$ 40 kg/m^2).

In addition, the main question is what can be done in terms of prevention to turn the tide on obesity which is at alarming level as risk factor for many health complications such as hypertension, hypercholesterolemia, coronary heart disease, and T2DM in healthcare ecosystem[6]? Citizens have to know and trust what is the first-line strategy, where to begin. Therefore, to promote obesity prevention, the patients' education has increasing the importance roles (leader in the prevention) with respect to physical activity and food consumption (for weight loss and for the prevention of weight gain *i.e.*, long term stability of weight loss).

General practitioners should address the importance of lifestyle modification by proper nutrition and by physical activity prior to the development of overweight measured through BMI (kg/m^2) which is associated with various levels of obesity. Challenging thinking for the obesity prevention is achieving weight loss and translated short-term improvements into long-term behavioral maintenance.

Lifestyle is the key to strategies to prevent T2DM[7]; dietary advice and physical activity are proposed as trusted obesity management strategies. A reduction in caloric intake by between 500 to 1000 calories per day is crucial related to strengthen any effort with overweight patients to set out ways to weight reduction. In terms of pragmatic advice to promote healthy eating to improve public health (*e.g.* reduce the burden from cardiovascular disease, cancer and other chronic conditions in the general), the dietary guidelines recommend eating 5 or more portions of fruit and vegetables daily[8,9].

A different, but equally valuable direction is based on the fact that obese people generally tends to have a sedentary lifestyle. Therefore, another aspect of GPs intervention to promote obesity prevention is recommendation to be associated increased fruit and vegetable consumption with physical activity[10]. Hence, this paper aims to effective management of obesity based on recommendations in terms of prevention and treatment formulated by general practitioners[11] regarding the prescription of physical activity for obesity management[12].

Primary care providers, including nurse practitioners that may positively impact obesity prevention in their communities, suggest that exercise needs to be performed continuously as part of the management regime of diabetes patients and it needs to be sustained over long periods of time. A physically active lifestyle is associated with diet which is rich in fiber, fruits, vegetables and low-fat dairy products, and low in fat.

The main potential of walking is to address the lack of physical activity. It is a form of physical activity that is both simple and can be performed by everyone. But it requires an objective measurement based on pedometer-calculated step count. Pedometers may be recommended to obese patients to monitor and increase the level of physical activity and to promote weight loss.

As prevention may be the most effective strategy to address the obesity growing concerns the next step may be to identify and implement effective intervention strategies. They will be achieved through better monitoring of prevention.

For gaining better insight of what is really occurring in the obesity prevention and obesity care and to point out to possible solutions a specific approach is by using the data evidence and benchmark exercise. This management practice is described on our paper in section "impact measurement".

OBESITY TREATMENT

It is difficult and impossible to have the final outcomes in terms of "success stories" for all cases in individuals with a BMI of 27 kg/m^2 or higher (in overweight and obese populations) exclusively with preventive measures that we have described above. We therefore need association prevention with treatments based on well-informed clinical decisions. Obesity treatment in primary care includes lifestyle modification on lifestyle factors linked to medications treatment (*e.g.*, dietary fat absorption inhibitors). What are existing treatment models of overweight and obesity? A treatment challenge is referring to:

1. Identify the challenges that make maintaining a reduced weight is so difficult (*e.g.*, poor adherence to behavioral regimens) and encourage patients with obesity to consider treatment;
2. Develop better strategies for prevention of weight gain and weight loss maintenance by considering medication (*e.g.*, make well informed decisions about drug choice or dosing) or surgery when appropriate;
3. Personalized treatment plan involving different treatments which can include highly structured diets, a high-protein diet, increases in physical activity, drugs, and bariatric surgery;
4. Recommend surgery when appropriate (*e.g.*, bariatric surgery is the only effective long-term treatment for obesity available);
5. Medication can be considered when behavioral weight-loss efforts wane;
6. Inform patients of the challenges to weight-loss maintenance to improve long-term outcomes in obesity therapeutics.

Clinical recommendations for obesity given by the general practitioners (*e.g.*, healthy dietary advices, dietary patterns, sound nutritional advices and the potential risks of different treatment drugs prescribed) are essential in terms of prevention and treatment[13]. Cost effective therapeutic approaches are required to provide the best quality of care when prevention fails. One of the greatest challenges of effective intervention in terms of treatment in most individuals with obesity, particularly in an environment that promotes energy overconsumption, is to improving long-term weight loss maintenance and to address the increased risk of serious medical conditions and offer treatment options[14]. For example, the medication used in USA is orlistat, a lipase inhibitor available without a prescription[15,16]. The benefits of lipase inhibitor-based therapies (fat absorption inhibitor), orlistat, has been shown to help maintain weight loss and improve cardiovascular risk factors with continued, long term use[17].

ADVANCED ICT SYSTEMS AND SERVICES FOR GP MONITORING

The pervasiveness of ICT and the increasing popularity of social computing by making active use of social media (Twitter, Facebook, YouTube) to communicate with doctors and with external audience such as patients, suppliers, and advanced ICT systems and services may have the potential to respond to the main question: *what can be done in terms of prevention to turn the tide on obesity?* The adoption and application of state-of-the-art Web 2.0 technology has brought a change to how people communicate and disseminate information with the use of Twitter, Facebook, YouTube, instant messaging and blogging associated with significant and measurable healthcare benefits from its use[18]. The main challenge, measured in terms of health-benefit gains, is the ability of health care systems to provide better adherence to obesity prevention. Adoption of ICT innovation (*e.g.*, big data analytics) technologies and online engagement are crucial in creating of effective data management by machine-readable data that describe other data (*i.e.*, searching through metadata).

Regarding implementation of the state-of-the-art ITC infrastructure technologies, the best solution is a cloud-based knowledge management platform for social healthcare in obesity. A "cloud" computing system is consisting of thousands of computers and servers, all linked together and accessible via the Internet. The cloud computing platform is now web based instead of being desktop or laptop based and facilitates doctor-patient collaboration, as both sides of users can

access the same programs and documents from wherever they happen to be located. The cloud system is developed to be infrastructure as a data service cost-effective system that facilitates monitoring of patient status, patient activity and compliance with therapy. Based on cloud data services, hosting in cloud can contribute to reduction the chronic disease burden. Cloud computing facilitates reduced initial costs[19] that lower the entry barrier for GPs and their medical organizations to deploy an extensive knowledge management solution.

Today cloud computing has become an essential tool to the connected health. The main strengths of the connected health technology based on cloud computing are the cost advantages[20]. The driving force of cloud for users is the flexible cost models. Given the current state of the art technology the costs advantages are based on the fact that cloud computing users do not need to own any computing resources (*e.g.*, server, storage) to support the capabilities they require. They are usually billed on a highly granular level for the usage (*e.g.*, server hour, storage per month, etc.) over a certain period of time. Additional details, cloud computing provides a centralized platform, which can be accessed from anywhere, by any authorized user, and at any time over the internet.

Moreover, a great advantage of new technology is interacting with software on web through a browser. Web services are constantly improving and constantly evolving and users have to do nothing for this to happen. Leverage the benefits of flexible, scalable and functionally rich cloud services using data service model can help meet regulatory and compliance needs (*e.g.*, European privacy laws[21], HIPAA- and PCI-compliant cloud solutions[22]).

The internet of tomorrow will be even more connected, intuitive and part of health-care interventions (*e.g.*, social networks, Wi-Fi devices) to improve the effective delivery and use of preventive and other high-value clinical services. The future of internet through data services will revolutionize epidemiology and surveillance to monitor trends and track progress, policy and environmental approaches to promote health and support healthy behaviors. Data service links between community programmes and clinical services to improve and sustain the management of chronic conditions. Development of cost-effective solutions for cloud IT infrastructure is a societal challenge, with a substantial impact on health care. Cost-effective cloud solutions let access and grow IT infrastructure and platform assets as healthcare process demands – without a large capital investment or compromising security, reliability or performance. To be technically and economically viable, a true infrastructure as a data service solution must work across countries, continents and the globe.

Figure 1 shows a formal description of the medical system architecture for GP effectiveness preventive intervention to increase the physical activity, change nutrition behavior and to assess existing treatment models of overweight and obesity. What can be achieved in primary care, for obesity is associated with significant health benefits is described briefly in the following:

Diet Caloric Restriction. This module is aiming a diet impact to maintain normal weight by healthy weight maintenance through low-calorie diet and aerobic exercise[23,24]. Success stories revealed the importance to promote revolutionary principle approach of eating low calories density food *i.e.*, eat more food while eating fewer calories and feeling the same degree of satiety[13].

Diet composition (Environment). Intervention with main focus on diabetes in improvement in dietary patterns national diet in increase vegetables and implementing existing knowledge in diet and how much changes will be needed for obesity prevention (intervention pattern in fat, sugar intake and micronutrients intake). A healthy diet (*e.g.*, consume more fibre and less saturated fat and dietary cholesterol) reduces risk of CVD possibly by modification of endothelial dysfunction and low-grade inflammation (play central role in CVD)[25].

Home exercise postnatal factors. Their translation into safer, more effective therapies, individuals could benefit from appropriate personalized and guided workouts, performance monitoring, action-directed instructions.

The future office, physical activity during the job. Web 2.0 platform is likely to produce more solid evidence of physical activity during the job[26]. Physical activity adherence measured with a self-repost specific scale (RPAQ questionnaire or PAR interview)[27,28,29].

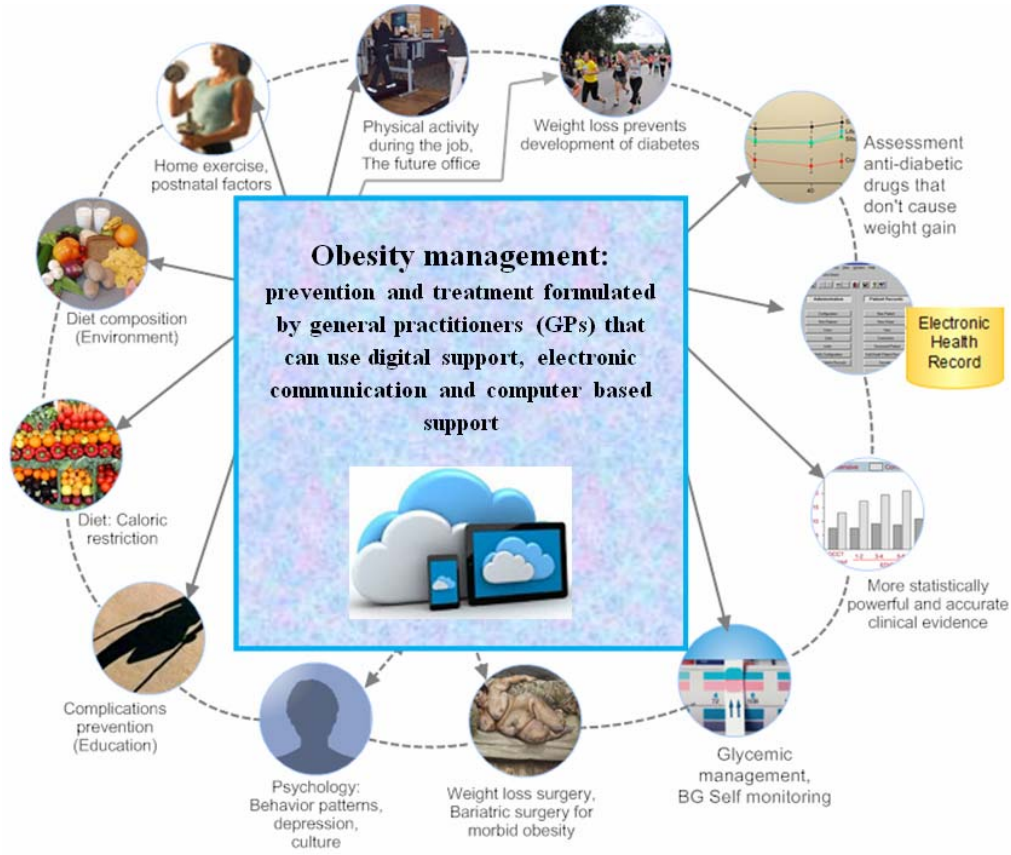


Fig. 1. Formal description of the medical system architecture for GP service delivery as effectiveness preventive intervention to increase the physical activity, change nutrition behavior and to assess existing treatment models of overweight and obesity.

Weight loss prevents development of diabetes patient education in terms of pre-diabetes preventive measures. Intervention in improvement in dietary patterns national diet in increase vegetables, pattern in fat, sugar intake and micronutrients intake implementing existing knowledge in diet and how much changes will be needed for Diabesity prevention intervention[25].

Assessment of anti-diabetic drugs offers around-the-clock access to a doctor, anywhere, to get advices about the adverse effect of new therapy.

Bariatric surgery* vs. *conventional medical therapy. A meta-analysis of weight loss and remission of type 2 diabetes mellitus (T2DM) evaluated in randomized controlled trials (RCTs) and observational studies of bariatric surgery *vs.* conventional medical therapy.

Electronic health record. Electronic Health Record (EHR) integrated with advanced data analysis can bridge the gap between the clinical care and the public health decision-making[30,31]. This facilitates better performance measures for the benefit of patients care delivery and providing opportunities for administrative and clinical cost savings (*e.g.*, eliminating duplicate lab tests). EHR is the key to the development, and ultimately the delivery of advanced data analysis solutions. Use the same EHR software which allows for clinical information to be shared local, regional, national or European level. Facilitate a holistic patient approach, assisted in patient follow-up, and reduced inappropriate (over) prescribing. The patient's consent has a pivotal role; patients are able to control the disclosure of their medical data (providing access rights accordingly the patient's consent).

IMPACT MEASUREMENT

Established evidence of care benefits, described in quantitative terms with key performance indicators is what is lacking is a systematic impact measurement of obesity prevention/treatment. The role of the data analysis is to provide feedback on the strong and weak aspects of the obesity prevention intervention (*e.g.*, to create awareness

of benefits to improve lifestyle based on data evidence in terms of weight loss). Healthcare has remained a couple of decades behind in apply today's best analytics techniques to make real-time decision-making to address issues in providing overall lower costs with better patient care (a proven approach as it is a current practice in business). In the following we introduce an example of impact measurement based on data analysis through an innovative data analysis solution.

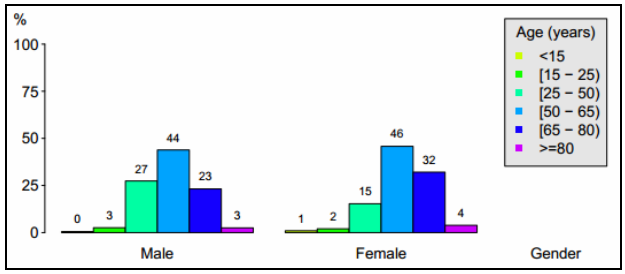
DATA SOURCES

Individuals with Type 1 and Type 2 diabetes (WHO criteria) living in Bucharest, Romania, were selected from the patients Register. We examined overweight or obesity among of 2475 newly diagnosed diabetes patients registered in 2011, $n = 1241$ (50.1%) women, and $n = 1234$ (49.9%) men. The numbers of records, their male/female split by age bands is given as Table 1 created through BIRO package. They were recruited by randomly selected physicians from National Institute of Diabetes, Bucharest, Romania. The C-M-H Chi-Squared test transformation was applied. Data Acquisition: collected standardized clinical information for the establishment of a dataset to assist healthcare services with information in connection with tasks of individual care of the patient. The following data items are compulsory and must be included in the electronic data recording:

1. Patient Identifier;
2. Disease (*e.g.*, type of Diabetes);
3. Sex;
4. Date of Birth;
5. Year of Diagnosis;
6. Episode Date.

Table 1

Age	Gender			
	Male (%)	Female (%)		N (%)
<15	6 (0.5)	12(1.0)		18 (0.7)
[15 - 25)	32 (2.6)	25(2.0)		57 (2.3)
[25 - 50)	338 (27.4)	190(15.3)		528 (21.3)
[50 - 65)	541 (43.8)	568(45.8)		1109 (44.8)
[65 - 80)	286 (23.2)	398(32.1)		684 (27.6)
>=80	31 (2.5)	48(3.9)		79 (3.2)
TOTAL	1234(49.9)	1241(50.1)		2475 (100.0)



STATISTICAL ANALYSIS

The main outcome of the BIRO project was a statistical platform providing functionality for development of robust, privacy compliant, accurate and cost-effective systems that facilitate better clinical trials and epidemiological studies for effectiveness gains in healthcare. The project's final review report (issued by the CEC) attests to the excellent results produced by the BIRO and EUBIROD projects, and certifies that the projects have successfully met all of their objectives[32].

BIRO technology is simpler and more accessible statistical package for general practitioners and their public or private companies, radically reducing time and efforts and lowering costs for data analysis. Details of this technology have been previously published[33],[34]. Many tables and charts have been created (automatically generated) for our global BIRO statistical report[33]. The tables and figures inserted into this chapter are only regarding to obesity but a lot of other similar tables and graphs have been created automatically with this innovative Open Source technology.

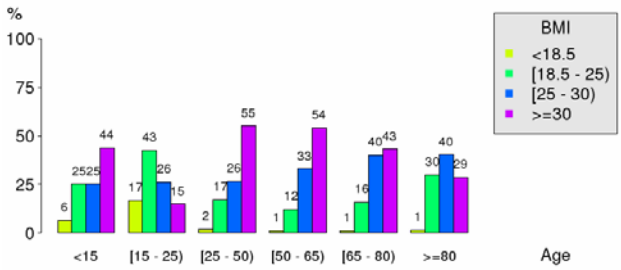
The body mass index (BMI) were measured by weight (kg) and height (cm) and calculated by weight in kilogram divided by height squared (m^2). Individuals were categorized into underweight BMI < 18.5 kg/m^2, normal-weight (BMI 18.5–25 kg/m^2), overweight (BMI 25–30 kg/m^2) and obese (BMI > 30 kg/m^2) groups. The anonymised records were collected on Excel spreadsheet, and a EUBIROD data set used for data exchange[35]. We used baseline data $n = 1797$ newly diagnosed diabetes patients in 2010, $n = 903$ (50.3%) male, and $n = 894$ (49.7%) female. As shown on Table 1 with the numbers of records and numbers of patients with an identified diabetes type and age band, created through EUBIROD package, mainly were recorded Type 2 newly diagnosed diabetes patients.

Table 2

BMI	Age						
		[15 - 25) (%)	[25 - 50) (%)	[50 - 65) (%)	[65 - 80) (%)	>=80 (%)	
<18.5	1 (6.2)	9 (16.7)	9 (1.8)	10 (0.9)	6 (0.9)	1 (1.3)	36 (1.5)
[18.5 - 25)	4 (25.0)	23 (42.6)	86 (16.9)	130 (12.1)	102 (15.8)	23 (29.9)	368 (15.5)
[25 - 30)	4 (25.0)	14 (25.9)	134 (26.3)	351 (32.8)	259 (40.2)	31 (40.3)	793 (33.4)
>=30	7 (43.8)	8 (14.8)	280 (55.0)	579 (54.1)	278 (43.1)	22 (28.6)	1174 (49.5)
	16 (0.7)	54 (2.3)	509 (21.5)	1070 (45.1)	645 (27.2)	77 (3.2)	2371 (100.0)

For Body Mass Index (BMI) the outcome categories are:

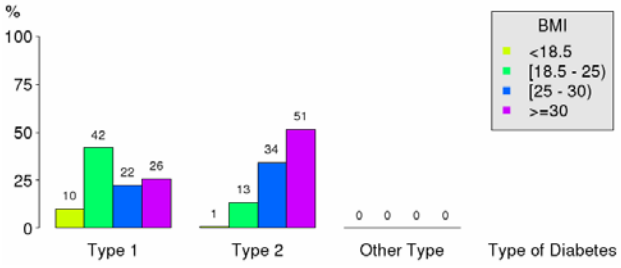
- underweight BMI below 18.5 kg/m^2;
- ideal weight BMI 18.5–25 kg/m^2;
- overweight 25–30 kg/m^2;
- obesity BMI equal and above 30 kg/m^2;
- morbidly obese adults BMI ≥ 40 kg/m^2.



As is shown in Table 3 the present study provides some epidemiological evidence for the overweight and obesity associated with risk of diabetes Type 2.

Table 3

BMI	Type of Diabetes			
	Type 1 (%)	Type 2 (%)	Other Type (%)	
<18.5	18 (10.1)	18 (0.8)	0 (0.0)	36 (1.5)
[18.5 - 25)	75 (41.9)	293 (13.4)	0 (0.0)	368 (15.5)
[25 - 30)	40 (22.3)	753 (34.4)	0 (0.0)	793 (33.4)
>=30	46 (25.7)	1128 (51.5)	0 (0.0)	1174 (49.5)
	179 (7.5)	2192 (92.5)	0 (0.0)	2371 (100.0)



DISCUSSION

There is no a magic answer to the question: what is the best strategy to turn the tide on obesity? However, this inter-disciplinary medicine-technology paper tries to present the update appropriateness of the obesity management (preventive and treatment structures and procedures) from the perspective of GP's role on one hand, and the new tool for data analysis on the other hand, which make better access to quality information. Therefore, the paper has stressed the growing importance of the demand of advanced data analytics which would lead to an improved management of clinical protocols and trials to tackle the challenge of overweight and obesity in a more aging population.

Obesity is a major public health problem that could account for the associated co-morbidities, which include cardiovascular disease, T2DM, and osteoarthritis. If the trend toward the increase in the obesity rates continues without preventive measures (which can be achieved in primary care) it is highly likely that obesity acts as a major risk factor for health (*e.g.*, coronary heart disease and T2DM). Also, obesity is associated with a shorter expectation of life, increasing morbidities and costs to the community.

Several epidemiological studies over the past few years have been focused on link between obesity and T2DM[3]. The studies revealed that the prevalence of T2DM and obesity is increasing worldwide associated with increased morbidity, poor quality of life and premature morbidity due to cardiovascular diseases. Also, obesity is a leading health problem in terms of generating unsustainable expenditures for the healthcare systems in most European countries. Usually, the cornerstone of obesity management remains behavior modification, diet and physical exercise. As is shown in Figure 1 we review here our current knowledge of modifiable risk factors and prevention/treatment strategies to provide future research directions that may further our understanding of this complex disease. As depicted in Figure 1 there are at least a few potential alternatives for patients who want the best in their care in terms of obesity issues and to have highest quality of life.

Effective management of obesity is crucial to the reduction of premature morbidity due to cardiovascular diseases. Unfortunately, pharmaco-therapy does not constitute an effective and uniform way of weight loss, especially in the long term; early life nutrition and metabolic programming is needed. The GP decision in terms of obesity prevention is made based on factors such as the needs for medical care to preserve a good health to

achieve active aging, both physically and mentally. Usually GPs are the first doctors the patient interacts with and at that moment GPs could play a definite role in providing global health evaluation. At general practitioner stage of healthcare there must be close links of patient with the clinician to ensure the safety and appropriateness of physical activity.

We presented what can happen in terms of benefits for patients if technology contextually relevant and easy to use by overweight/obese persons and patients with T2DM (the most common type of diabetes). The scope of paper is to strengthen the role of top technology which can lead to innovative, user-friendly and personalised services that can be accessed easily. Due to the increased use of mobile technology (*e.g.*, cellular-enabled pedometer, cellular-enabled blood glucose meter with its graphic user interface)[36] as well as the increasing availability of public information, data and online services connected care platform over a secure connection based on mHealth is helpful in addressing obesity challenges[37].

Performance and system validation of a medical system architecture for GP effectiveness preventive intervention as presented in Figure 1 through advanced data analysis technology (such as the BIRO technology) is crucial for effective management of overweight and obesity. The European Commission is pleased with BIRO's success outcomes[32]. No other research group has achieved such advanced results in advanced data analysis in diabetes to date. This technology on top of electronic registry helps to deliver more efficient and cost-effective advanced data analysis to achieve better transparency in obesity and diabetes care outcomes. Those who can benefit from such technology are health organizations, policy-makers and medical professionals to derive actionable information triggering appropriate healthcare interventions.

Diabetes-related disabilities reduce quality of life with enormous increase of direct and indirect costs for patients admitted to hospitals. The estimates show that more than three-quarters of the global healthcare expenditure due to diabetes in 2011 are for people between the ages of 50 and 79 years[38]. For example, hyperglycemia in admitted patients is an indicator of poor outcomes, with increased length of stay and health care cost[39,40]. In the UK diabetes currently accounts for approximately 10% of the total health resource expenditure and is projected to account for around 17% in 2035/2036[41].

According to the IDF Diabetes Atlas, (fifth edition, available here: http://www.idf.org/diabetesatlas/5e/healthcare-expenditures) "the estimated global healthcare expenditures to treat diabetes and prevent complications totaled at least US dollars (USD) 465 billion in 2011. By 2030, this number is projected to exceed some USD 595 billion". Therefore, just making modest improvements in diabetes prevention by regularly and reliable monitored of obesity prevention through advanced data analytics can gain huge rewards in managing a complex and demanding illness.

Who can benefit also by using BIRO technology are research scientists in health care and authors of dissertations and thesis if they wish to save time and efforts in creating numerous tables and charts through reliable health data automatic analysis. An example of data analysis in connection with obesity was done in this paper with BIRO technology as it is described on previous section of this paper. BIRO system provides integration of a standardized European diabetes registry (database engine), an Open Source statistical analysis (R statistical engine) and communication software for automatic global data analysis. It is best summarised as build a new technology to generate statistical reports based on IT for health innovative solutions and software tools aimed at two distinctive steps of measurement outcome and quality healthcare in diabetes:

- *Step 1:* Local electronic data retrieval to achieve evidence based medical practice, data treating and processing (*e.g.*, data de-duplication, cleaning, validation, linking), and data automatic analysis and generates reports with the local outcomes to continuous monitoring for a wide range of indicators about diabetes care.
- *Step 2:* Digital data formatting enables information to be shared over secure networks. Technology can extract relevant data from local data sources, perform statistical analysis and automatically create, in matter of minutes, a complete report of BIRO indicators (*e.g.*, automatically create a file of PDF format in size of few hundred pages) [34,42,43].

A benefit of local BIRO applications well-focused to drive scientific progress (as an integrated healthcare platform) is that the GPs can analyse their own data and produce statistical reports including tables and graphs with the results

regarding the outcomes and quality of the health care services. BIRO is a support tool for research data sources. It provides a quantitative understanding of actual clinical practice in handling problems of diabetes complications in different European locations[21]. Also reduce time, effort and complexity for decision makers to implement new evidence for risk complications analysis.

The local statistical reports generated are aiming also to provide factual evidence about the performance of individual services in supporting the health professionals in taking the best possible decision for prevention, diagnosis and treatment of diabetes. For research staff BIRO is an open source, user-friendly fast and reliable technology, an ideally tool on providing the best access to health information sources on landscape of big and reliable health data analysis.

For obesity BIRO is a long-term metrics which are needed to convey risk, judge interventions, and motivate behavior. The behavioral risk factors like physical inactivity, unhealthy diet, tobacco use and harmful use of alcohol which may have effect on our health condition[44]. The platform will include capability for comprehensive monitoring on a regular basis to allow the clinician to select and target intervention based on patient need, ensure appropriate therapy, and to follow progress. Regarding patient education and counseling it is important to note that the GPs generally believe that obesity is caused by psychological and behavioral factors and are ambivalent about the effectiveness of the majority of available solutions[45].

What is lacking is a systematic widespread EHR system of maintaining and securing electronic patient records to better inform clinical decision-making. All data surrounding the patient care registered by healthcare professionals in daily clinical life (*i.e*., valuable data and useful data) can be used for exchanging health information between clinicians across an organization that delivers patient care.

Electronic Health Record (EHR) integrated with advanced data analysis can bridge the gap between the clinical care and the public health decision-making. This facilitates better performance measures for the benefit of patients care delivery and providing opportunities for administrative and clinical cost savings (*e.g*. eliminating duplicate lab tests). EHR is the key to the development, and ultimately the delivery of advanced data analysis solutions.

The first successful electronic medical record system was realized under the banner of the EU project "*Black Sea Tele Diab*" *(BSTD)*[46], based upon standard *e.g*. the Good European Health Record (GEHR)[47] and the CEN ENV 13606[48,49] on "Electronic Communications" and EU research projects *e.g.* Inco-Copernicus. This is a success stories project, initiated by the authors of this paper, which created the first EHR system in diabetes in Black Sea area.

The project BSTD was coordinated by Sheffield University, Hallamshire Hospital (UK), with software quality led by The Hull University (UK). The system was developed using a modular design and an object-oriented method[31,50,51]. The GEHR contains the set of concepts dealing with co-operation (patient records transfer) between healthcare providers around the care of a patient.

CONCLUSION

Development of patient-oriented services based on Cloud computing solutions to support patient empowerment, self-care, adherence to prevention plans and treatment and to turn the tide on obesity is a social necessity and a global success-imperative for most healthcare systems. Expected impact of this paper is reinforced medical knowledge with respect to provide better functions in collecting and integrating information on the diet and physical activity, metabolic profile, physiological parameters, and other relevant clinical data in order to create a successful prevention, monitoring and treatment protocol to patients who are overweight. This work represents, we believe, a novel and important contribution to the literature in this field.

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