The use of Digital Tools to promote Physical Activity as preventive factor for Cardiovascular diseases. Barrier and opportunities for Health Public Systems

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Abstract. Being drawn in the emerging relevance of the diffusion of m-health services, this work analyses the weight of digital tools in promoting Physical Activity as preventive therapy for people at risk of Cardiovascular Disease. We examined the issue at public policy level, investigating about factors able to favor the adoption of m-health in this field. The paper reports about the initial deducing findings coming from the conclusion of a first piloting study, in which we executed exploratory targeted qualitative interviews to privileged witnesses able to be informative as experts of the area. These findings appear to claim ï before looking at technological aspects ï for a change in the framework of intervention in the general public policy setting, pushing for a change in vision, approach, institutional framework, and cultural setting. Aspects such as: absence of guidelines, lack of specific training as well as the necessity to rethink governance and accountability frameworks have been found as challenges to be faced at policy level before actually thinking about certification and effective adoption of the most effective digital tool.

Keywords: M-health, Digital tools, Public sector, Physical activity, Cardiovascular disease,

1 Introduction

The use of mobile computing resources in healthcare has been growing since the end of the last century [1, 2]. These tools add value to clinical practice because they facilitate access to clinical information, improve the exchange of information, provide clinical decision support [3, 4]. The technological development of these tools led academics to study benefits and barriers regarding their practical effective adoption [5]. On one hand, since the beginning, it was clear that there were benefits, such as cost saving [6], time saving [7, 8], errors reduction [9, 10], improvement of medical practice [11, 12]. On the other hand it was also clear that there were barriers hindering their practical adoption, such as personal factors (i.e. discomfort in using the tool) [13], non-integrated systems [11], physical design and data entry problems [13], fragility and maintenance problems [14], technical difficulties [15, 16]. Apart from these

specific barriers, related with the technological components of the tools, there were ñother barriersò [5]. These other barriers regarded the broad organizational and managerial support, such as lack of institutional support [17], inadequate availability of the tools and lack of support in choosing among competing technologies [13], lack of needs or motivation and insufficient personnel training [11].

Along the years, the technical barriers have been tackled because, the advances in mobile technologies, enabled devices to perform functions not even imagined few years before [18]. The evolution has been possible thanks to the development of a new field, known as mobile health or m-health [19]. A m-health system improves healthcare service delivery processes by offering support and services to healthcare providers or target communication between healthcare services and consumers [20], thus changing the traditional modes of information sharing and dissemination [21]. Nowadays m-health constitutes a central component of pervasive healthcare [22] and represents an important instrument to increase health promotion, disease prevention, provision of care, and monitoring [23].

While m-health tackled technical barriers, the ñotherò barriers, that is institutional organizational and managerial ones, increased and represent now the main aspect to be tackled [24]. The point is that, nevertheless the technical relevance of the information and communication technologies tools, the success of m-health depends on its adoption by healthcare providers [24]. This adoption has to address specific aspects. Differently from other information technologies, it is mainly consumer-centered and consumer-driven [25]. M-health interventions are a patchwork of small-scale projects [23]. Most of m-health apps work as black boxes with little use of theoretical basis [26].

In synthesis, nevertheless the pervasiveness of mobile devices in most of nowadays everyday activities, ñthe use of m-health applications to provide health information and care is particularly challenging and calls for specific strategiesò [19: 212].

Starting from the above considerations, this paper intends to investigate the role of the public sector in addressing specific strategies to favor the adoption of a m-health system.

We chose to frame our investigation upon aspects related with policies to contrast Cardiovascular Diseases (CVD). CVDs are the number one cause of death globally [27]. Most CVDs can be prevented by addressing risk factors. An important vehicle, in this regard, is the promotion of physical activity (PA). Due to its effectiveness upon the quality of life of people at risk, PA is much more effective than many medical prescriptions [27]. But despite the growing recognition of the need to promote PA [28], its actual wide diffusion as a therapeutic preventive factor is still lacking [29].

The use of proper m-health technologies ï like exergaming (active video games); mobile device apps; health wearables; augmented reality games, global positioning and geographic information systems (GPS/GIS); and virtual reality ï represents an important new facilitating effective instrument to boost PA in people at risk of CVD [30], but a wide use of these digital tools is still lacking [31].

Starting from the above reported considerations, our study intends to investigate the issue, at a public policy level, looking at the role of the public sector in designing proper strategies for the adoption of innovative m-health systems in this field. The

study focuses on the general health system per se, not on one or another specific digital tool or service. It therefore investigates aspects regarding public health design, legal frameworks and general services to favor the adoption of m-health.

Considering the above reported issues, we aimed at answering the following specific research question:

Which is the role of public sector in favoring m-health adoption?

Since we were investigating a specific role in developing strategies for m-health adoption, we considered that we had to frame our study in a different context. Indeed, while health technology adoption studies influenced theories on the adoption of technologies [32] like the Technology Adoption Model [33] or the Unified Theory of Technology Acceptance and Use [34], the specific aspect related to the role of public sector in favoring (or not) m-health technologies adoption, among the different involved actors, are still under-investigated [35, 36].

We decided to frame our investigation on a methodology developed in 2018 by Tate et al. [37] to depict ï when studying digital innovation in the public sector ï the fuzzy zone between the time in which an opportunity (or need) is known and the time when serious effort is devoted to its actual adoption.

This paper presents the initial deducing findings coming from the conclusion of a first piloting study. We executed exploratory targeted qualitative interviews to privileged witnesses able to be informative as experts of the area.

The paper is structured as follow: the next paragraph describes the issue, illustrating the relevance of PA as preventive factor for CVD and the relevance of new digital technologies as boosters able to promote it. In section three we depict the theoretical framework regarding the fuzzy front end of digital innovation in the public sector, while in the fourth one we describe the research design and method. The fifth paragraph illustrates the research results and the sixth concluding one reports about results discussion, study limitations and indications for further research improvements.

2 Cardiovascular disease, physical activity, digital tools

According to World Health Organization, CVDs are the number one cause of death globally, with an estimated 17.9 million people died in 2016, representing 31% of all global deaths [27]. Most CVDs can be prevented by addressing behavioral risk factors, such as tobacco use, unhealthy diet and obesity, physical inactivity and harmful use of alcohol [27].

Among the relevant factors able to prevent CVD, there is leisure-time physical activity (PA). It has been indeed demonstrated that PA shows a linear negative correlation with the risk of CVD, regardless of age and gender [28]. Apart from the importance on health, it must be also considered that CVDs financial charge is huge as well as the impact in terms of general social costs. In 2017 the American Heart Association accounted CVDs cost in USA as $555 billion [38]; a study by Bernick and Devis [39] shows that the total costs of CVDs in main European economies are estimated at ú122.6 billion in 2020, with an increase of ú20.5 billion over six years.

PA can enhance health, being better than any other medical intervention. It indeed has the double effect of being both much less expensive than an health intervention on an already ill patient and, most of all, much more effective upon the quality of life of people at risk [29].

A new frontier to promote PA is represented by the use of m-health [40]. New technologies such as mobile device applications, health wearable devices, and active video games, have been implemented to promote PA [30, 41, 42]. Innovation in this field, offered several different tools to promote PA to prevent CVDs [31, 43]. M-health in this field, includes: exergaming (active video games); social media; mobile device apps; health wearables; mobile games, augmented reality games, global positioning and geographic information systems (GPS/GIS); and virtual reality [44].

All the above considered, we decided to concentrate our study on a still under-investigated aspect, that is the role public sector in favoring the adoption of m-health services to promote PA to prevent CVD.

An objection to our point of view about the issue, might be, that it is not relevant to look at public sector innovation per se, because it is not compulsory to have public health services, to increase m-health promoting PA to prevent CVDs. On the contrary, our study is focused on the general system per se, not on one or another specific tool or service. In other words, our focus regards public health design, legal frameworks and general supporting services to design strategies aiming at favoring the adoption of m-health.

3 Theoretical framework: the fuzzy front end of digital innovation in the public sector

Considering our study aim, that is the role of public sector, and considering the lack of specific models to investigate its relevance in designing specific strategies to favor m-health adoption [19, 35, 36], we decided to frame our investigation looking at a methodology properly developed to study digital innovation in the public sector.

In the last 20 years digitalization changed public administration and public policy [45], but this transformation has not been as huge as initially thought, and most of all, it did not lead to such a great re-design in all sectors and countries, having nowadays a patchy situation [46].

The main issue, appears to be the fact that, in studying any innovation in the public sector, it is necessary to consider that it is not achieved per se in a blink. It is rather the result of a process locally embedded: in a specific context (such as a specific policy sector with specific state and governance traditions); in a specific time; within specific power relations [46]. More explicitly, it must be noted that, differently from private sector innovation, public sector one is typically aimed at services rather than products, thus requiring more interaction, negotiation and dispute resolution with stakeholders [47]. It is therefore necessary to tackle aspects like: inflexible cultures, legal requirements, a need for inclusiveness and diversity, and lack of a policy framework [48].

Nevertheless public sector peculiarities, any open digital innovation has to face what has been named the fuzzy front end (FFE), that is the fuzzy zone between the time in which an opportunity (or need) is known, and the time when serious effort is devoted to the development project, where there is the challenge of analyzing good ideas, for deciding which one to pursue [49].

In 2018, Tate et al. [37] depicted a methodology for carrying out open innovation for digital public services, concentrating their analysis on the FFE. Considering the aim of our investigation upon the role of public sector in the adoption of m-health to promote PA to prevent CVDs, we decided to inspire our analysis to their methodology.

In particular within Tate et al.ôs framework we depicted our study on the relevance of barriers and opportunities. On one side we investigated, taking them from the factors depicted by Tate et al., the barriers to be mitigated to tackle constrains towards innovation. On the other side, we analyzed (always taking the factors from the ones depicted by Tate et al.) the opportunities to be enabled for favoring digital innovation stimulating m-health adoption.

In synthesis, our starting point was the following consideration: why, nevertheless the existence of new digital tools to favor PA to prevent CVD, there is not yet a widespread adoption of these technologies within proper m-health preventive programs? Which is the role of public policies in this sense? In answering these questions, we investigated the FFE regarding the adoption of m-health, looking for barriers to be mitigated and opportunities to be enabled.

4 Research design and method

Aiming at investigating the FFE in the public m-health policy design, we decided to run a case study addressing ówhyô and óhowô questions [50]. In particular, being at a preliminary stage of investigation, we executed exploratory targeted qualitative interviews [51] to privileged witnesses, able to be informative as experts of the area [52].

We run our case study in Italy. Italy has a public universalistic health system, planned at national level and governed at regional one [53]. Private initiative to deliver health services is anyway unrestricted and, in some cases, also supported, by the State, in Public Private Partnerships [54]. Therefore in Italy there is a good level of both public health design, as well as public-private co-production schemes in health service delivering and also an open private health services market. We therefore thought that Italy could represent a valid setting to start our analysis because the ñcohabitationò of different health services systems (public, private, PPP) could reduce the risk to have data influenced by the relevance of a prominent one in administrating and delivering health services.

The paper reports about the initial deducing findings coming from the conclusion of a first piloting study. We interviewed three professors of cardiology involved in both research studying and clinical work upon CVD, who were also engaged in the promotion of PA. We interviewed also two researchers of physical motor activities,

specialized in the research upon wearable technologies to favor PA and having also experience in the design and implementation of experimental projects to favor PA in rehabilitation phases after diseases.

The interviewed persons were working in three different universities, all having clinical health services for people with CVD as well as linked rehabilitation and prevention services. The three professors of cardiology were found among those available in a set of Italian professors of cardiology with a record of publication on preventive factors (found among the participants of a national congress on the relevance of preventive factors). For what regards the researchers of physical motor activities, they were both assistant professors in the same university of one of the interviewed professors of cardiology. Indeed when planning our research strategy we did not think about the possibility to interview people coming from the world of physical motor activities. It has been one of the interviewed professors of cardiology that illustrated us that there were collaborations with researchers belonging to this field. She thus suggested us two persons to be contacted and they accepted to be interviewed by us.

Interviews were run between January and May 2020 and conducted in interviewers and interviewees native language (Italian). The average in time length was about 15min. The records transcriptions were analyzed through a content analysis [55] having, as factors of analysis, those framed by Tate et al. [37]. We indeed develop our research through a deductive thematic analysis, having a theoretically-driven coding [56] inspired to Tate et al. framework [37]. We therefore run our content analysis making a specific categorization of the factors individualized by Tate et al., inferencing them through the analysis of the records of the interviews. The interviews were analyzed separately by two different researchers and then crosschecked. Considering that we had no previous data to facilitate coding, we decided to not use any specific assisted computer software. The content analysis results were then translated into English, and finally re-analyzed for the redaction of this work.

The illustration of the research results is reported in the next paragraph together with some more indications about the profiles and roles of the five interviewed persons, all aspects we found useful for a better understanding of the relevance of the results themselves.

5 Research results

Our content analysis found, among the fifteen factors identified by Tate et al. [37], the relevance, of the following six ones, as illustrated in Table 1.

Table 1. Analyzed factors within FFE.

Challenges	Barriers
Proactive services	Digitizing without transforming
Design-led innovation and agile services	Lack of shared standards
Translational roles	Internal culture barriers

In the following sections of this paragraph we illustrate what emerged from the analysis upon each of the considered factors and how the results of the content analysis confirm both their presence and relevance.

5.1 Proactive services: the necessity to challenge the lack of preliminary facilitating factors

An important preliminary aspect regards the possibility, thanks to the use of digital tools, to develop a much more proactive prevention service especially for people at risk of CVD. Indeed, according to the scheme developed by Tate et al. [37], being proactive means to develop services, not only able to respond when and where appropriate, but being able to anticipate the needs of citizens. In our specific case prevention is fundamental and the promotion of PA represents, as highlighted in paragraph 2, a valid effective factor.

The point is that all the interviewed cardiologists revealed as this aspect lays, before talking about the use of digital tools, on the relevance of a change in the consideration and delivering of services, both on the side of the deliver and on the one of the recipient. In particular there should firstly be a definition of clear guidelines on how to ñprescribeò PA and to whom according to different clusters of people at risk. This aspect has never been solved due ï according to what emerged from our interviews ï to the fact that, although the recognizing of the validity of PA is not new, there have never been defined specific protocols to be followed. F.F. even affirmed ñthe topic is not new at all, I remember that since I was still a student, my professor talked about the importance of PA (é) nowadays, thanks to digital tools, we could really develop precision medicine using PA to prevent CVD risks (é) there should be agreed guidelines not only for cardiovascular specialists, but also and especially for GPs who are at strict contact with the patientsò. S.B. highlighted ñthere should be a real promotion of continuing education and training courses, for MDs in general, about the relevance of PA as preventive factor for the health in general not only to prevent CVDò.

In synthesis it appears that there is, by the medical side, a recognition of the validity of developing proactive services, but before thinking at the development of them, a change in the framework of intervention in the case of CVD prevention is needed.

5.2 Design-led innovation and agile services: the gap between trials and actual wide use of tools

Design-led innovation was defined as an opportunity-based approach to innovation, where early versions of new design artefacts, and the associated business vision and business models co-evolve [37] focusing also on customer empathy, ideation, experimentation, constant evaluation, and prototyping [57].

In our specific case it seemed that, such a kind of tools suffers, in reaching its aim, the lack of usersô wide and long lasting participation. In this case the PA researchers we interviewed underlined the existence of a great gap between successful trials and actual mass production. In particular P.I. highlighted ñLook, there are really a lot of academic articles showing the importance and validity of these tools, but one thing is to have participants in a trial having an experimental group and a control one, another

thing is to have patients that follow the prescriptions (é) and few possible users do not push companies to invest in developing these toolsò. In this sense the difficult to lead towards usersô behavioral change, as it will be described in 5.6, appears to be one of the greater aspect to be faced.

By the side of the cardiovascular specialists it was once again affirmed that GPs, who should be really ñFamily Doctorsò as often defined in Italy, being at strict contact with their patients should favor the change. F.F. affirmed: ñFirst of all it is necessary to sensitize (é) it is different if you are a healthy person or one at risk of CVD, you should teach patients to never arrive at pain thresholdò. In synthesis, it appeared that it is fundamental that GPs, together with motor and PA specialists teach people how to do PA before giving them valid tools to favor and measure it, but in this sense S.B. affirmed ñBut could you imagine family doctors to prescribe PA? do you think that then they could easily work in reading patients data developed by digital tools? They have not been trained to do that and it is not an easy process to be developedò.

5.3 Translational roles: a challenge at governance level

The last challenge we considered was what Tate et al. [37] named translational roles, seen as the possibility to have facilitators with credibility in different environments being thus able to bridge boundaries.

In our specific case this appeared to be the hardest one to be challenged. Indeed both at educational training level, but especially at policy one it seems that there are two different frameworks very far one from each other. At educational level health operators (from MDs to nurses) are very far from motor and PA trainers specialists. On this aspect F.F. affirmed ñthere ought to be an integration, within physiology courses of the possibilities to develop treatments for grey patients [intending with this expression the person at risk who is arriving at possibly facing an acute event]ò, but apart from education it seemed there was a lack at institutional level. A.S. affirmed ñIt is not easy to involve around the same table MDs and PA motor activity specialists as we are, (é) when you plan and then apply to develop an experimental trial, ethical commissions do not easily agree because of this admixture of MDs together with PA specialists in dealing with patients personnel dataò.

Indeed, nevertheless the evidence, in the last decade, of the importance of PA in public health policy, the discussions about the political issues connected to the contemporary role of PA and amateur sport in public health appears to be still at a preliminary stage. While there is an established corpus of policy-orientated research articles on public health and lifestyle factors including PA, the promotion of PA and grassroots sport is remarkably absent from the public health research agenda [58]. Running a research upon national governments of EU countries, we found that the two paradigms are seen as very far one from each other. Health policies are, most of the times in charge of a specific Ministry or, when not having it, they have anyway a specific body within Welfare Ministries, while motor and PAs are considered within sport activities, which most of the times are included within educational ministries and sometimes with cultural heritage and tourism ones. This aspect appear to be an evidence of how distant, at government level the two fields are. It is a matter of governance and policy design. F.F. affirmed ñHealth Ministry should do more to favor ama-

teur sport and PA (é) there should be communication campaigns as the ones developed to prevent cancer through periodical screeningò. By the side of motor and PA specialists, P.I. declared ñYou see now the point because you are running a research, but you have to consider that, at policy level, sport is not seen much in the value of grassroots sport and PA for people wellbeing, rather than it is seen as the possibility to grow up elite athletes as well as for its relevance in the education of youngsters, being in this last case, closer to social policies rather than to health onesò.

In synthesis the point appears to be that, in our specific case, before thinking about the way to favor the wide use of digital tools, there are preliminary aspects to be faced at policy design level.

5.4 Digitizing without transforming: problems in the tool reliability and in usersô commitment

A major barrier found by Tate et al. was referred to the facts that many e-government initiatives were simply digitizing without transforming the design and delivery [37]. In our specific case, looking at an initiative inspired to the development of e-health services, three main obstacles were found in the possibility to use digital tools to promote PA as preventive factor for CVD.

All the aspects were highlighted by the two motor and PA specialists. First of all they highlighted that there is still the presence of a digital divide, because, many patients are old and not so used in a daily connection with hi profile digital tools. This first aspect appears anyway decreasing and decreasing in the last years because of the possibility to use more friendly developed tools able to easily interact with common smartphones, thus requiring, by the side of the users, neither specific complicate expensive tools to be acquired, nor particular knowledge for interacting and using the tool in a proper way.

What appeared to be a positive factor to solve the first problems revealed itself as a new barrier. Indeed we were told that these new friendly technologies (mobile app, smartwatches, etc.) are not completely reliable. In particular P.I. affirmed: ñFew of these friendly commercialized tools own a scientific certification about their effectiveness and reliability. You absolutely have to avoid errors and an approximation in measurement efficacy. A light imprecision of these instruments might become a risk for the personò. But if the first two obstacles could be overcome, favoring the use of only reliable friendly tools, although they are few and expensive, it was the third one to appear nearly impossible to be tackled.

Our interviewees told us that these tools are not revealing themselves useful in achieving what in the specific literature is named Behavioral Change Technique (BCT), seen as the possibility of a specific tool of intervention, to really modify the high-risk behavior of the patient. Indeed it has been seen that in nearly the majority of the users, these tools are effective only for few months, then there is a kind of disaffection in using them which reflects itself in a slow decrease of PA by the patient, or even in an inconstant one, and this is more risky than not doing PA at all. At a practical level these tools are used and thus effective at the beginning, like if the users were experiencing a new game, but then, along the time, inner wrong risk behavior, take over again stating the history of the patient. This problem is common to most of pre-

ventive therapies based on the necessity to stop risky behaviors (e.g. quit smoking, following a correct diet, etc.). In the case of digital tools to promote PA a new frontier is object of study: the possibility of linking activity trackers to the achievement of results and prizes (like if you were playing a digital competition) as well as the possibility to interact, through linked social media channels, with other people facing the same problem.

5.5 Lack of shared standards: a problem of certification and accountability

If the first barrier might be overcome in the near future, the other two appear very far to be tackled requiring a change in the way of thinking, both at policy level as well as at the one of practitioners and users.

In particular a great obstacle is represented by the lack of shared standards and appears to be strictly linked with the challenges to be faced, as described in the previous sections of this paragraph. A common point is indeed that, at this stage, stating the absence of guidelines, the lack of specific training in most of practitioners (from GPs to nurses, as well as motor and PA trainers), PA cannot be prescribed as a medicine. In the case of a drug, there is always a protocol to be followed for prescribing it to a patient and international and national specific institutional bodies (e.g. European Medicines Agency in EU; Food and drug Administration in USA; Agenzia Italiana del Farmaco in Italy, etc.) certified both its efficacy for the treatment as well as a low risk for what regards possible side effects. Moreover in the case of drugs prescriptions, as well as in the case of an intervention by a specialized team on an acute patient, both private insurance systems as well as national health services, can account costs, referring to what agreed for the medicine and/or to the specific diagnosis-related group cost for a clinical intervention. Can we imagine a same setting for the possibility to prescribe the use of a digital tool to favor PA as preventive factor to reduce CVD risk?

5.6 Internal culture barriers: the barrier of the barriers

The last barrier we depicted from the analysis of our interviews, through the lens of the FFE methodology, regarded internal cultural barriers which we found not only on the public side as found by Tate et al. [37] (risk aversion, lack of incentives to change) but even on the users one.

As appeared clear in all the above reported subsections of this paragraph, challenges to be faced and barriers to be overcome, regard a change in governance and planning setting that should firstly bridge boundaries between the health intervention setting and the motor and PA ones. The use of digital tools appears to have the potentials to do this, because proper certified digital tools able to favor exergaming, being thus effective also as Behavioral Change Techniques, really can achieve such an important target both for peopleôs quality of life as well as health spending reduction. The problem is represented by the fact that such an achievement should firstly face a cultural change in approaching the issue and this seems, according to the analysis of our interviews, far to be reached. In this sense F.F. affirmed: ñOne might check at distance if the patient is doing PA, but MDs continue to lag behind in using e-health services and

digital toolsò. Moreover S.B. said: ñIn many cases it is ñsaferò for a MD to prescribe a medicine, because the prescriptions follows specific protocols and the responsibility to take right dosage at the right time as prescribed, is up to the patient (é) for the use of digital tool you firstly need a change of visionò.

Our interviewees told us that the cultural barrier was present also on the patient side who is not able to perceive the prescription of the use of a tool to monitor his/her PA to prevent risks not as a therapy. S.B. said in this sense: ñin most of the cases it is the patient that interrogates about the relevance of PA and asks for a medicine, an aspect which represents more a therapy by his/her point of viewò. P.I. made an explanatory last example ñDo you know which was found, at academic level the most powerful digital tool to change behaviors promoting PA? (é) One which was not thought for this reason: Pokémon Go (é) even very lazy youngsters started doing PA to participate to the gameò.

6 Discussion and conclusions

Starting from the consideration that the success of m-health depends on its adoption by healthcare providers [24], this paper aimed at studying public sector role in the adoption of m-health services to promote PA as preventive factor for CVDs.

Knowing that the use of m-health applications is particularly challenging and calls for specific strategies [19], we concentrated our analysis on public health design, legal frameworks and general services to favor the adoption of m-health.

Since this aspect is still under-investigated [35], there are not yet specific models to explore the issue [36]. We therefore decided to frame our investigation looking at a methodology properly developed to study digital innovation in the public sector. We chose the one depicted by Tate et al. [37]. This methodology considers the relevance of the FFE, identifying barriers to be mitigated and opportunities to be enabled for favoring digital innovation in the public sector.

We developed our research, through a deductive thematic analysis, having a theoretically-driven coding inspired to Tate et al. framework. We executed exploratory targeted qualitative interviews to privileged witnesses, able to be informative as experts of the area. We therefore run a content analysis making a specific categorization of the factors individualized by Tate et al., inferencing them through the analysis of the records of the interviews. The analysis found the relevance, for the aims of our study, of six of the fifteen factors depicted by Tate et al.

Our investigation certainly has limitations, both in number of interviews and for what regards its location in only one country. Anyway its findings, coming from the conclusion of this first piloting study, address two main aspects on which we think it will be interesting to continue the investigation.

A first aspect regards theoretical implications. Considering the premises about the under-investigated issue and, especially, the ones regarding the lack of a model, our findings seem to open a route in this regard. Our results suggest that, an appropriately modified version of the Tate et al. methodology, properly tailored upon m-health

adoption, could represent a new framework for investigating the issue, maybe arriving at the possibility to propose a model.

A second aspect regards practical implications. By the analysis of our findings it appears clear the recognition about the validity of the tools, but an actual adoption of a m-health scheme appears not easy. Indeed interviewees underlined that, before thinking at an actual effective adoption, a change in the general public policy setting is needed. They told us about the problems in the prescriptions rather than about the actual efficacy or about the deficiencies of the digital tools. Indeed the absence of guidelines, the lack of specific training in most of practitioners (from GPs to nurses, as well as motor and PA trainers) together with the necessity to rethink governance and accountability frameworks, appear to be the first challenges to be faced at policy level before actually thinking about a proper certification able to allow an effective adoption of m-health to promote PA to prevent CVD.

In this sense the relevance of the public policy context in public health appears to be predominant. Indeed while mobile technologies are influencing private sector and private organizations are under increasing pressure to apply digital technologies to renew and transform their business models [59] the m-health adoption is still challenging [19, 23, 25, 26].

Our findings confirm that public sector requires more interaction, negotiation and dispute resolution with stakeholders [47], having to tackle aspects like: inflexible cultures, legal requirements, a need for inclusiveness and diversity, and lack of a policy framework [48]. Present practices, regarding CVDs care and prevention, seem to represent one of the main obstacles to be addressed before thinking about an actual adoption of m-health to promote PA to prevent CVDs. Indeed all interviewees reported about problems in prescribing the digital tools rather than in clearly assessing its validity and effectiveness.

In this sense the actual adoption of a m-health appears to be impeded by the lack of legal frameworks as well as traditions in this sense. According to our findings, these aspects influence even a proper implementation of the technological tool according to possible standards for a prior needed certification of it, according to what requested for the adoption of a tool in health its actual adoption.

In this sense the last statements presented in 5.6 are really evocative. The point is that a technological tool designed for fun (as Pokémon Go is) requires much less certifications than one which can be prescribed by a medical doctor. Indeed while the m-health to promote PA is not widespread yet, many fitness technologies are a prominent example of the societal trend towards personal informatics [60]. How is this possible? The answer lays, according to our findings, in the necessity to afford the issue at a different level. Although if having a similar structure in terms of algorithms, a m-health app, differently from a ñgenericò fitness one, requires proper certifications and must be implemented following specific steps. The point is that, if at a preliminary stage, there is still a lack in how to certify and prescribe PA, there will never be any company interested in ñadjustingò an app thought for fun (and already sold in the market) implementing it according to what required for a certification to be a m-health tool. In this sense the role of public policy is fundamental and the lack of inno-

vation in this field, hinder the private initiatives of companies which could better implement the app.

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