

Interactive Business Models for Telerehabilitation after Total Knee Replacement: Preliminary Results from Tuscany

Francesco Fusco and Giuseppe Turchetti

Institute of Management-Management and Innovation (MAIN) Scuola Superiore Sant'Anna,
Pisa, Italy

{f.fusco,g.turchetti}@sssup.it

Abstract. To date Total Knee Replacement (TKR) is one of the most performed procedures in Italy; likewise, rehabilitation after TKR accounts for 182 million of euro each year. The deployment of ICT was able to increase the efficiency in several areas, but in healthcare sector still fails to be widely adopted. According to management literature, business modelling is crucial for a product success and the stakeholder engagement is valuable as well. In this direction, we designed 4 telerehabilitation business/governance models through brainstorming session and developed them interviewing a large sample of the stakeholders involved into the telehealth arena. Whereas the decision makers highlighted the need of gradual changes in healthcare, the preliminary results showed the interest in exploring innovative governance pathways able to directly involve the patients in the healing process and reduce waiting lists over the regional healthcare service. Future research aims to capture the others stakeholders perspectives.

Keywords: Business model, telemedicine, canvas, stakeholder, total knee replacement, telerehabilitation, rehabilitation.

1 Introduction

Total Knee Replacement (TKR) has an important role in healthcare expenditure, as it is the 21st most performed surgical procedure in Italy in 2013 [1,2]. In this sense, “Istituto Superiore di Sanità” observed the TKR performed in Italy has more than doubled from 2001 (26’694) and 2011 (63’125). “Agenzia Nazionale per i servizi Sanitari” (Age.na.s.) forecasts this trend to further increase in the next years, with a reduction in the average age of the target population for knee prostheses surgery [3]. Therefore, the increment in TKR procedures is going to have an effect on the knee rehabilitation as well. Although rehabilitation showed to improve the patients’ recovery after surgery [4], the expected increment in TKR procedures could lead to serious concerns with respect to the socio-economic sustainability of knee rehabilitation. According to Piscitelli et al [5], rehabilitation for TKR currently accounts for almost 182 million of Euros per year. Since years Information and Communication Technologies (ICT) caused a revolution in user’s everyday life. Although mobile

communication and internet diffusion have widely spread in several fields, with an improvement in terms of GDP and productivity growth [6], they have not reached the same diffusion and impact in healthcare. In this sense, the drivers responsible for the success of telemedicine programs are still uncertain and further research is required. According to Osterwald, business model for innovative services/products should support the value creation for the whole society (i.e. patients, caregivers, medical personnel and decision makers) rather than exclusively for the firm that provides them [7]. Although the aims of the stakeholders could partially vary, none of them can be neglected. Therefore, we aim to detect the best business model able to optimize the value creation for most of the telerehabilitation stakeholders. In the current work, we report the preliminary results coming from the public healthcare decision makers interviews that we performed in the “Area Vasta Nord-Ovest” (ESTAV) in Tuscany (i.e. Livorno, Pisa, Lucca, Viareggio and Massa-Carrara health care districts).

2 Methods

The whole project was based on the design science research methodology (DSRM) [8], which is a five steps approach aimed to define the objectives, the design, the development, the demonstration and the evaluation of a new solution. The context and the objectives have been described in the previous section; the current work addresses the following two phases: design and development. Design was dealt with brainstorming sessions with researchers of the Institute of Management and a pool of experts composed by employees of a primary telecommunication company, a physiatrist and a TKR patient. The development phase is still ongoing as we are currently running face-to-face interviews to decision makers, physiotherapists, patients and caregivers. The present work is focusing on decision makers. During the interviews, they were asked to provide their believes related to the Osterwald’s canvas sections [7] (key activities, key partners, key resources, customer relationship, customer segments, value proposition, channels, cost structure) for each business/governance model proposed. At the really end of the interviews they were asked to rank the models according to their preference. The current work will provide an insight on those sections of the Osterwald’s canvas which are mostly of interest to the decision makers’ (i.e. key activities, key resources, customer/patient segments).

2.1 Key Activities

This section of the interviews proposed three different scenarios, composed by not dividable couple of activities (one acquisition of the device activity and an activity to manage telerehabilitation sessions), ranging from full control of the telerehabilitation service (i.e. acquire the device and completely follow-up the patients) to delegate the telerehabilitation tasks to the Telco (i.e. payment of the service based on the pay-as-you-go scheme and leave the complete control of the telesessions and data to the Telco providing the service). While the intermediate option provided a partial control on the service (i.e. rental of the devices , the Telco manages the telesessions, but reports

the data to the healthcare units). The interviewed persons were asked to state their preference for the 3 sets of activities. Additionally, they were asked to provide any further activity they would include and to match the two preferred activities listed in the previous questions.

2.2 Customer/Patient Segments

Decision makers were asked, basing on their experience, to provide the best profile for patients to candidate for telerehabilitation service for each model. The items enclosed in this section were: gender, maximum age, education, cohabiting status and working status.

2.3 Key Resources

To capture the importance of single resources items for the success of telerehabilitation service, we administered them the Visual Analogue Scale (VAS) for the following resources flows: local health authority (ASL) expenditure, regional healthcare reimbursement, national authority payment/incentives, incentives and patients' payment. The VAS value ranged from 0 to 10 – where 0 stands for “not important resources flow” while 10 represents “extremely important resource flow”.

3 Results

3.1 Designing Phase: Models for Telerehabilitation

The brainstorming sessions during the designing phase resulted into 4 different governance/business models, which were structured increasing the level of innovation from the first model up to the fourth one. From the second model up to the fourth, we designed our models within a pay-for-performance incentives frame. This choice is due to the evident easiness in collecting data through telemedicine and the opportunity to have an impartial tool to report performance data. The administered models are further described in following subsections.

Model I. The first model (Figure 1) is conservative as most of the process flows follow the usual healthcare pathway in place in Italy. To summarize, the Italian National Healthcare Service (Ita-NHS) is organized into regional healthcare services (Regional-NHS). The regional-NHS budget is based on regional taxations and “intramoenia” activities (i.e. private care procedures performed into public healthcare units - part of the revenues of the physician is shared with the healthcare unit)[9,10] and it is divided among the primary care units (i.e. ASL) according to specific goals. The regional-NHS covers almost the whole cost, with a small fixed fee to be paid by patients (i.e. “ticket”).The ASL provides half of the number of the rehabilitation service in usual care and the other half at patients' houses through telerehabilitation (mixed UC/TR).

Model I

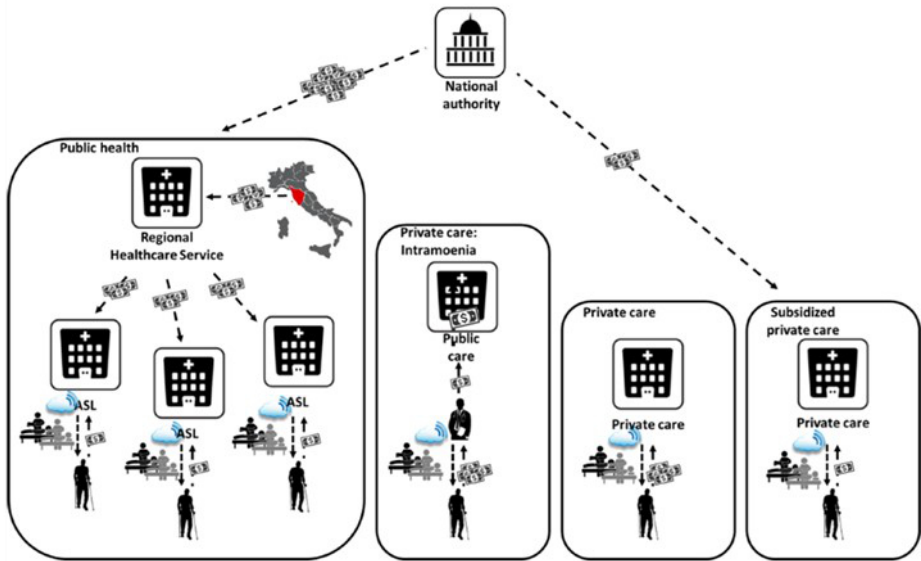


Fig. 1. Telerehabilitation business/governance models: Model I

If the regional budget is not sufficient to cover the whole healthcare service expenditure, the National Authorities (i.e. Ministry of Health and Ministry of Economy and Finance) cover the necessary amount of resources to deliver healthcare in such regions. Likewise, national authorities can subsidize private care units, who deploy the same mixed UC/TR service, to preserve the accessibility to the minimum level of healthcare service. In addition, both “intramoenia” service and private care would deliver the UC/TR service. The devices (i.e. a couple of sensors and tablet) are provided by the Telco supporting the service to each ASL.

Model II. The second model (Figure 2) supposes a partnership between the Telco and the ASL. The first will provide the service and the latter will perform the healthcare sessions according to mixed UC/TR scheme. The data obtained during the telesessions are used to observe patients’ adherence to the prescribed treatment. The adherence rate is adjusted on socio-demographic characteristics of the patients, in order to avoid inequity between different kinds of patients (i.e. younger patients are more likely to understand and use the service rather than elderly ones. In addition, patients with co-morbidities could have a lower adherence unrelated to their willingness). The telesessions data will be used to scale-down the patients co-payment according to their adherence rate. In other terms, the higher is the patient’s adherence, the lower is the patient’s payment. The telesessions data are forwarded to the national authority, which will cover the part of the ticket not paid by the patients with good and normal adherence. From societal perspective the incentives would be justified due to the ability of the service to ensure a high quality care service (because of the ensured adherence to treatment) and the reduction of productivity loss (patients would perform the telesession after the working day).

Model II

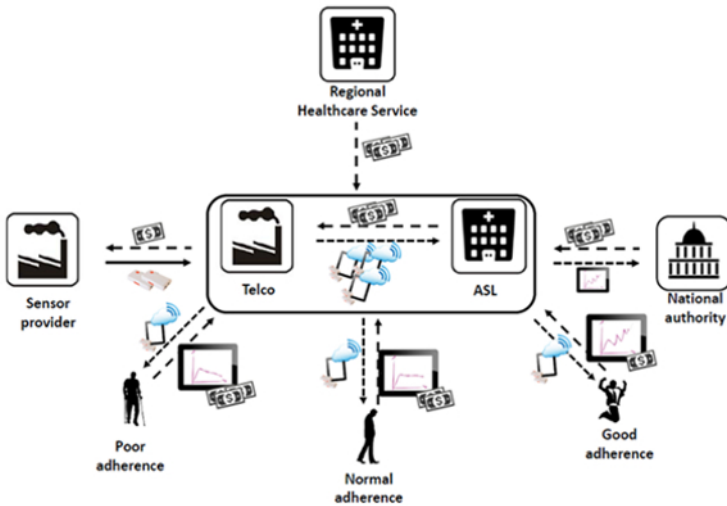


Fig. 2. Telerehabilitation business/governance models: Model II

Model III. The third model (Figure 3) is based again on a partnership between the Telco and the ASL. However, in this case the medical personnel is encouraged to push the innovation into their unit thanks to incentives according to their performance. The patients will follow the mixed UC/TR treatment, and their data are used to assess who among the medical personnel achieved the best adherence in his/her group of patients. Also in this case the scheme pay-for-performance is adopted to cover medical personnel's incentives and those expenditure belonging to an improvement of the performance in the healing process supported by telesession data.

Model IV. The fourth model (Figure 4) supposes that the healthcare units could have a different rate of access to their services resulting into long queues for a treatment in some geographical areas and a temporary unemployment of medical personnel in other areas. Therefore, we proposed a partial digitalization of physiotherapists, able to perform telesession or teleconsultation for those healthcare units with a lack of physiotherapists or for those areas with difficult access (e.g. rural areas). In the case of telesession the virtual physiotherapist will remotely monitor the patients. While in the teleconsultation case, the physiotherapist will provide support to other medical personnel to perform the rehabilitation session. The early stage of the model adoption supposes semi-virtual physiotherapists due to the usual care activities in the healthcare units. However, we believe this model could result into a new occupation category like full time virtual-physiotherapist. The healthcare units receiving the remote procedures will pay a fee to those providing remotely the medical personnel, who shares part of the revenue to the forming healthcare unit. Finally, the national authority will provide incentives due to the improvement in efficiency of treatment (i.e. reduction of waiting list and transportation of patients into a different healthcare unit) to the pool of experts and to the healthcare units they belong to.

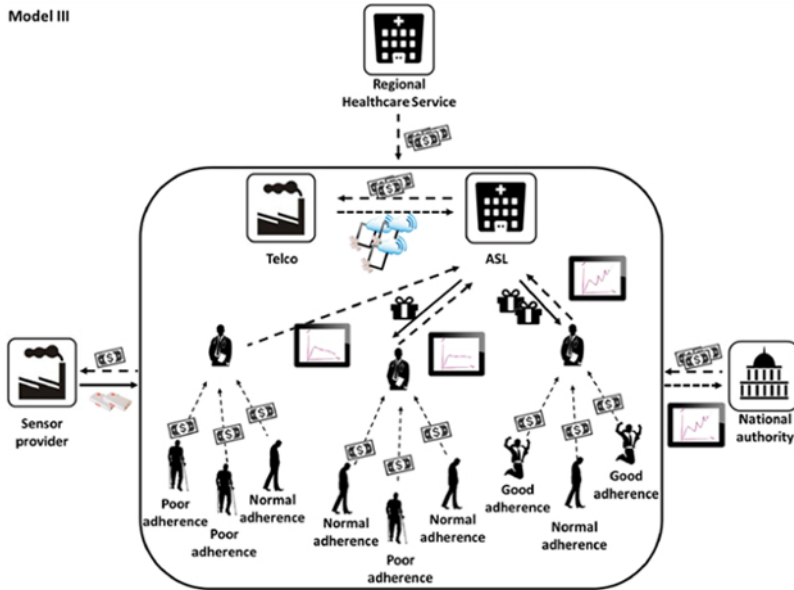


Fig. 3. Telerehabilitation business/governance models: Model III

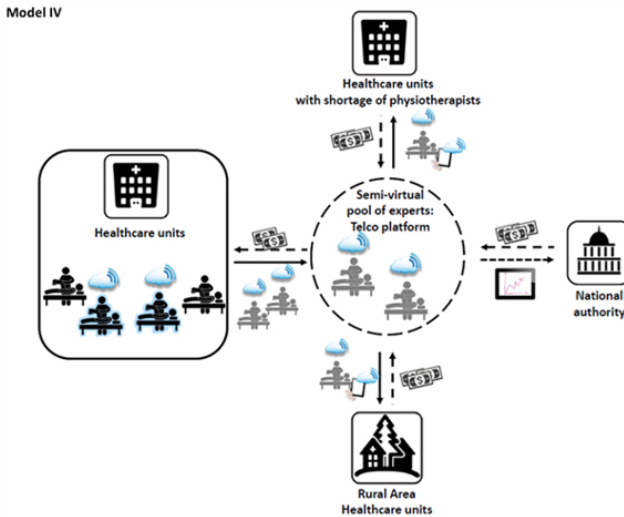


Fig. 4. Telerehabilitation business/governance models: Model IV

3.2 Development Phase: Insights from Decision Makers in Tuscany

The development phase is still ongoing, in this section we report the major remarks from interviews with decision makers of the public rehabilitation units in ESTAV. Currently we have interviewed 4 out of 6 of the directors of rehabilitation units (Livorno, Pisa, Lucca and Massa-Carrara), the average age is 56.6 years and the 80% of

them is male. All of the interviewed persons have at least a personal computer and use it for the following reasons: working purposes (within the healthcare unit and to contact their patients) and in their spare time.

Key Activities. All the stakeholders interviewed agreed toward the intermediate set of activities. The first and the third models have registered the same preferences towards the intermediate option (3 choose it as first option and 1 as second option); likewise, the second and fourth registered the same trend. However, both of them showed a higher willingness to delegate the telerehabilitation session to Telco, especially in the fourth model. However, in the first three models when asked to match the preferred activities across the proposed scenarios, they preferred the rental option (only one preferred the pay-as-you-go option). On the other hand, the 50% of stakeholders choose the intermediate option to manage the telelessons, while the other 50% choose the full control option. The fourth model led decision makers to prefer the pay-as-you-go option (3 out of four), while only one still preferred the rental. Finally the intermediate option to manage telelesson is the most preferred also in this case (50% of the decision makers).

Customer/Patient Segments. The target population for a telerehabilitation service would not vary across the different business/governance models. There is a large consensus on: gender, education level, cohabiting status and working status. Briefly, the best profile for a telerehabilitation service user is male or female, cohabiting, with a secondary school degree (i.e. high-school) and works as freelance professional or at least as employee. On the other hand, the responses about the maximum age range from 65 years (50%) to 70 years (50%). Although most of the features did not vary across the different models, one decision maker raised the concern about gender and age for the second and third model. He/She stated that the performance schemes would be a problem for older patients; additionally, he/she supposed it would work better for male patients rather than females.

Key Resources. When asked to describe the importance of some resources items, the responses varied accordingly with the proposed models. Although in the most conservative scenario (Model I), the regional-NHS reimbursement has a pivotal role, it becomes decreasingly important according to the innovativeness of the model. On the other hand, the importance of national authority payment/incentive increases from model I to model III. Nevertheless, in the fourth model there is not a defined trend, the ASL expenditure was the most important item, while the importance of the other items level out.

Model Comparison. At the end of the interview, all the decision makers were asked to express their preference list for the showed models. The most preferred one was the second model; although none of the remaining models prevailed on the others, there was a slightly preference for the first one as second choice.

4 Discussion

Since years business modelling has played a pivotal role in determining firm success; in this sense Chelsbrough stated the importance of business models up to be responsible, if

not properly designed, for failure even for good products [11]. Considering the lack of value co-creation to be the most important issue in the new services development [12] and the co-creation pathway to be determined by the firm's willingness to collaborate with the other stakeholders to achieve a shared benefit [11]; our work aimed to provide 4 business/governance models and refine them according to the stakeholders needs and insights through face-to-face interviews. Here we propose some remarks from the preliminary results outlined in this paper. When asked to describe whom of the TKR population would benefit from telerehabilitation, decision makers agreed on patients' characteristics. In addition, changing the models does not seem to have an effect on the maximum age of the target population and its working status. In other terms, decision makers seemed to appreciate the advantages of telerehabilitation on patients' management independently from which model would be implemented. The only concern about age and sex was raised in model II from a decision maker, which supposed telerehabilitation would yield better results in younger male patients. However, the stakeholders agreed about the working and the cohabiting status, since telerehabilitation service could reduce productivity lost especially for patients and caregivers working as freelance professional. The control of follow-up tele-session was a crucial point in the key resources section. None of the interviewed was interested in completely acquire the devices in any of the proposed models. However, they would prefer to control the tele-sessions; nevertheless, the trade-off between buying or renting the devices, sacrificed the full control on tele-session in favour of the rental scheme. The only model able to modify this trend was the fourth, where it was preferred to completely delegate the telerehabilitation session to the Telco. The key resources section registered a high variability, especially for the third-party payer reimbursements. Although the regional-NHS decreases of importance from model I to IV, the impact of the national authority incentives increases over the 4 models. The incentives for telerehabilitation seems to be more likely to be accepted if aimed to reduce the patients' co-payment (model II), rather than encourage physiatrists and physiotherapists to push the innovation over the healthcare units. This could be related to the difficulties in defining the incentive size and nature (i.e. positive incentive for higher performance, penalties for low performances), leading to the reluctance to risk in this kind of incentives schemes [13]. Therefore, if there is a willingness to innovate, involving more the patients into the healing process (model II), there is still some reluctance to completely overturn the healthcare system. Whereas the interviewed persons choose the second model (as first choice in the 50% and 25% as second choice of the interviewed), they highlighted the need of a gradual introduction of innovative services in healthcare through usual governance pathway (model I). The paper showed the preliminary results of a broader work. Although the decision makers enrolment is still ongoing, here we reported the insights of the majority of them. Nevertheless, we could draw some not definitive conclusion about telerehabilitation in ESTAV. The top-management of public healthcare units positively responded to hypothetical scenarios with ICTs able to reduce expenditures and waiting lists. There is a growing trust towards third-party service provider (i.e. Telerehabilitation experts deployed by a Telco), proved by the willingness to partially delegate the service (i.e. the intermediate dominated the other options in the key activities section). Likewise, the acceptance of innovation in public health is relying on national authority legislations and incentives.

The patients' age does not seem to be a constraint from decision makers perspective, who were confident in telerehabilitation usability for the elderly. Further conclusion will be drawn in the future steps as in this sense the other stakeholders perspective is too important to be neglected; in addition, economic evaluations based on the different models are claimed to prove the telerehabilitation models sustainability. The future research will focus on gathering believes of the medical personnel, patients and caregivers. In addition, a decision model [14] will simulate the socio-economic burden of these models.

Acknowledgments. Authors thank Miss Maral Mahdad for the enlightening conversations, the support in the designing and questionnaire development phases. We also thank the healthcare units' directors from Livorno, Lucca, Massa-Carrara and Pisa districts for participating in the interviews. Finally, we thanks Telecom Italia spa, who funds the project.

References

1. Ministero della Salute. Tavole Rapporto SDO (2012),
http://www.salute.gov.it/portale/documentazione/p6_2_8_3_1.jsp?lingua=italiano&id=16
2. Torre, M., Luzi, I., Romanini, E., Zanoli, G., Tranquilli Leali, P., Masciocchi, M., Leone, L.: The Italian Arthroplasty Registry (RIAP): State of the art. *G. Ital. di Ortop. e Traumatol.* 39, 90–95 (2013)
3. Cerbo, M., Fella, D., Jefferson, T., Migliore, A., Paone, S.: P.M., L, V.: Agenas - Le protesi per la sostituzione primaria totale del ginocchio in Italia,
http://www.salute.gov.it/imgs/C_17_pagineAree_1202_listaFile_itemName_4_file.pdf
4. Bohannon, R.W., Cooper, J.: Total knee arthroplasty: Evaluation of an acute care rehabilitation program. *Am. Acad. Phys. Med. Rehabil.* 74, 1091–1094 (1993)
5. Piscitelli, P., Iolascon, G., Di Tanna, G., Bizzi, E., Chitano, G., Argentiero, A., Neglia, C., Giolli, L., Distante, A., Gimigliano, R., Brandi, M.L., Migliore, A.: Socioeconomic burden of total joint arthroplasty for symptomatic hip and knee osteoarthritis in the Italian population: A 5-year analysis based on hospitalization records. *Arthritis Care Res (Hoboken)* 64, 1320–1327 (2012)
6. Gruber, H., Koutroumpis, P.: Mobile telecommunications and the impact on economic development. In: *Economic Policy Fifty-Second Panel Meeting*, pp. 22–23 (2011)
7. Osterwalder, A., Pigneur, Y., Smith, A., Movement, T.: *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (2010)
8. Peppers, K., Tuunanen, T., Rothenberger, M.A., Chatterjee, S.: A design science research methodology for information systems research. *J. Manag. Inf. Syst.* 24, 45–77 (2007)
9. Regione Toscana. Delibera Giunta Regionale 595 del 30.5.05,
<http://www.uisp.it/firenze/files/areaperlagrandeta/LEGHEAREE ATTIVITA/AreaAnziani/Documenti/DeliberaGRn595.pdf>
10. Regione Toscana. Accordo quadro regione Toscana – trasporti sanitari,
<http://www.misericordiaonline.org/servizi/contratti/page/AQR Toscana.pdf>

11. Chesbrough, H.W.: *Open Business Models: How to Thrive in the New Innovation Landscape* (2006)
12. Lin, F.R., Hsieh, P.S.: Analyzing the sustainability of a newly developed service: An activity theory perspective. *Technovation* 34, 113–125 (2014)
13. Kahneman, D., Knetsch, J.L., Thaler, R., Kahneman, B.D.: Fairness as a Constraint on Profit Seeking: Entitlements in the Market. *Am. Econ. Rev.* 76, 728–741 (1986)
14. Fusco, F., Turchetti, G.: A Cost-Effectiveness Analysis for Total Knee Arthroplasty Tele-rehabilitation: Proof of Concept of A Decision Model. *Value Heal.* 17, A380 (2014)