

2.1 Background

For the team staff, athletes' good health and performance constitute two objectives that are continually interacting and affecting one another. At the same time, they are the responsibility of the sports physician, as well as the coaching staff and all the members of the work team who interact under the sports physician's coordination, at the service of athletes, the team and the sporting entity.

These tasks therefore require knowledge and skills specific to the profession exercised. Working closely with athletes will help integrate the knowledge of the particular circumstances surrounding the competitive sport in general, and the team in particular. This will make it possible for decisions to be made by taking due account of the factors involved in each athletic phenomenon.

Medical criteria must govern the way situations are managed. They are based on the following:

- Respect for the patient, particularly during the relationship that the professional establishes with him on equal terms, so as to avoid authoritarianism or paternalism.
- The sports physician must not just diagnose, but also educate the patient, motivate him to actively participate in identifying and solving his health problems, without imposing.
- The sports physician must be a health communicator who knows how to reach the patient and communicate with him, in order to jointly participate in the decisions, within the context of an injury process.
- Respect for accepted and applicable medical practice: the athlete, like any patient, has the right to receive the best possible treatment, based on evidence and experience. Injured athletes, who are especially vulnerable, should be protected from unproven 'miracle therapies' and procedures.
- Respect for the ethics of human relationships and the ethics that must guide every medical act. Here the obligation of absolute confidentiality applies to the health professional, which proves difficult to fulfill when the health of media personalities is involved.
- Respect for efficiency, valuing the cost-benefit ratio and opting for the solution that is considered optimal from the point of view of the pathology in particular and according to the player's psychosocial and economic circumstances.

Team sports physician and all those who participate in the health care of athletes are, in some way, victims of the success of modern medicine, as patients find it difficult to come to terms with the injury and its possible sequels. There are circumstances under which the pressure exerted on athletes causes them to hold the medical team accountable. For example, when, given the time it takes to deal with an injury process, sports goals cannot be achieved.

Medical records and clinical course

The medical record is the document reflecting the relevant points of the medical act itself. It is the written or verbal account of the patient's clinical situation, and can be obtained through the patient's own account or that of third parties involved. It is the professional himself who decides what needs to be reflected in the record and how it should be presented. The professional's name must appear on each part of the medical record, since any anonymous record will result in an incomplete medical record. Health institutions and clinical departments of the sports organizations which decide to issue such acts are responsible for doing so on paper or by means of telematic devices that enable the data and documentation related to the medical record to be recorded, archived and used.

Content of an athlete's medical record:

- a.** Data relating to the patient's affiliation, which make it possible to locate him or her (i.e., home, telephone, e-mail) and those of the relatives of his or her choosing, to whom the athlete's possible injuries must be notified.
- b.** Documents signed by the patient and by the sports physician, reflecting that the athlete has been informed of the nature of the medical act, of the need to enter it into the medical record, and of the way the data analysis and processing will be carried out where necessary. Signed general consents do not authorize the future exploitation of medical record data in the absence of due prior notification.
- c.** Initial sports medical examination:
 - i. - Personal, family, sports and toxic history.
 - ii. - Pathological history, allergies, previous admissions, previous surgeries, history of injuries and concussions.
 - iii. - Device-based systemic exploration, with special attention to the cardiopulmonary and locomotor system. Peripheral and central

neurovascular exploration, and exploration of the sense organs, are critical in most athletes.

- iv. - Vaccination history, nutritional condition and state of rest.
 - v. - Anthropometric examination.
 - vi. - Rest electrocardiogram.
 - vii. - Echocardiogram.
 - viii. - Ergometry with exercise electrocardiogram.
 - ix. - Spirometry.
 - x. - Other functional tests.
- d.** Biological monitoring data, clinical analysis, anthropometry evolutionary measurements and functional tests.
- e.** Pharmacological and supplementation record, which may need to be consulted at any time before an anti-doping test. Regarding the drugs, which are specific to nursing, the indication justifying them, the proposed dose, as well as the treatment duration and compliance, must be specified.
- f.** Record of each of the medical processes, which must follow a time sequence, comprising a start, an evolutionary clinical course and an end. In each process it is advisable to verify:
- i. - The patient's data, the reason for consultation and the clinical examination.
 - ii. - The initial clinical judgment, with the differential diagnosis, the diagnosis plan and the initial therapeutic measures.
 - iii. - The requested diagnostic tests, with access to images and reports, which must be properly retained.
 - iv. - It is advisable for the diagnosis to use a coding system. The Orchard Sports Injury Classification System coding (OSICS-10; goo.gl/4Zctpi) is extensively used in competitive sports. It is a code recommended by the UEFA, FIFA and the ICO. In the OSICS coding system, each diagnostic process is coded with four letters: the first one refers to the anatomical location of the injury or, if it is a medical condition, to its development or postoperative condition; the second letter refers to the type of tissue, organ or system affected by the injury; the third and fourth letters are specific to each situation.
 - v. - The therapeutic plan, which will detail the personal recommendations, the modifications of the physical activity plan, the medication, the use of orthotics or mechanical aids, the surgery (if recommended) and the rehabilitation plan, in which the goals and the required time are established. An approximate and temporary estimation, which may be especially appreciated in some contexts, can be inferred from this set of data.

- vi. - The evolutionary process or clinical course, on a daily basis, whenever it is considered appropriate.
- vii. - The records of physiotherapy and post-professional sports rehabilitation. Among these, the therapeutic programming is documented, based on the established goals and the follow-up plan. On the basis of this record, and in accordance with the plan, the effectiveness of the proposed plan can be assessed. These records are the responsibility of the therapist responsible for carrying them out. In intermediate and long duration processes, a sequential approach of goals and a breakdown of the process into stages are advisable, with previously established criteria objectively justifying advances in the process or instances where it comes to a standstill.
- viii. - Evaluation, imaging and functional tests that are used to monitor the process.
- ix. - The discharge for resumption of competitive performance, together with limitations and recommendations for secondary prevention.
- x. - Copies of the documents sent to insurance companies, stating the beginning and end of the process, as well as the documents related to the on-going follow-up of the athlete's condition, which are often requested by insurance companies.
- xi. - The tests related to the injury mechanism, in the form of videos, are relevant enough to be stored along with the medical records, to make them easier to access.
- g.** The follow-up materials and the records from other health professionals, not strictly related to clinical processes. The medical record may thus contain separate sections for all of the following:
 - i. - Nutrition: where intolerances, recommendations, allergies and needs are recorded, as well as supplementation and monitoring of the nutritional status, body composition and supplementation needs.
 - ii. - Chiropractic: orthopedological follow-up, along with the appropriate records of the static and dynamic footprint; possible needs for orthotics and their characteristics.
 - iii. - Psychology: with special confidentiality in related aspects.
 - iv. - Physiotherapy: with aspects specific to supporting preparation for training and matches, notably massage, bandages, stretching exercises, discomfort management and athletes' day-to-day life. The recording of physical actions for the recovery of afterload fatigue is of particular importance.
 - v. - Nursing: where the specific processes of this discipline are recorded, especially those referring to biological sampling,

medication, parenteral therapy, skin care and adnexa, injury handling and vaccination.

- vi. - Other professionals who participate on a relatively occasional basis by assisting the athlete must have their say in the medical records, in which they can record their activity in a consistent and orderly manner.

Access to medical records and clinical documentation is reserved for their owners, who are:

- The patient, given that it is written for his benefit and refers to his health and privacy.
- The sports physician, as the intellectual and scientific author of the account and the leader of the medical team supporting the athlete.
- Each of the professionals contributing something in the medical record is considered the owner of the part they contributed.

The health center or the sports entity cannot be considered the owners of the content of the medical record. The right to property, which must be respected by all, refers to the access, disposition and use of the medical record, and to its secrecy and record-keeping obligations.

Data recording and analysis

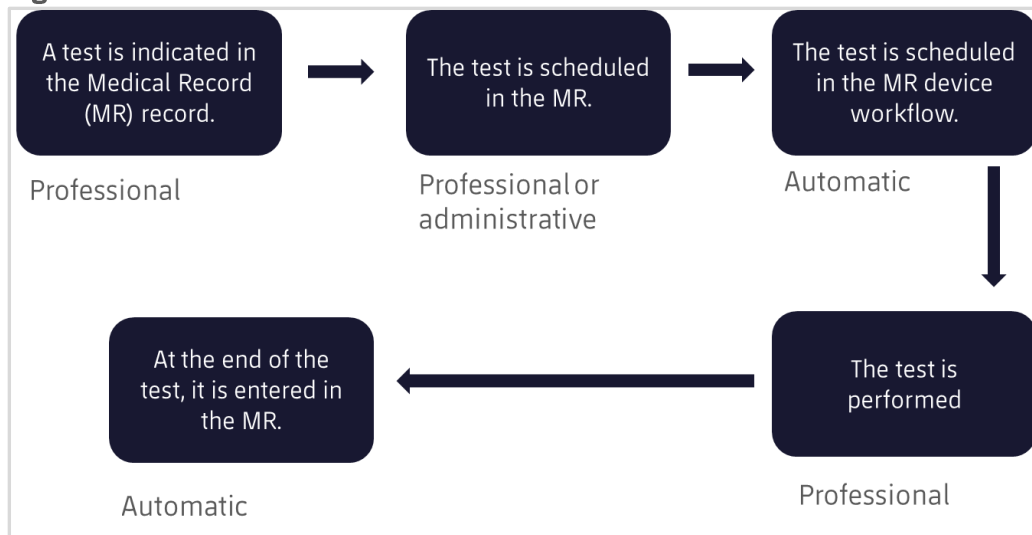
Data must be recorded safely. The possibility of doing this electronically and consistently will allow for the definition of access authorizations and record traceability. The model must meet the security requirements set out in the regulations, which ensure the inviolability of the records, data confidentiality and access traceability. Ideally, it should also allow cross-sectional, longitudinal and comparative analysis. When focusing on team sports, some of the related data should be analyzed individually or collectively. This probably can only be efficiently performed by means of electronic records.

A planned medical record model, in the form of parametric fields as closed and as quantitative as possible, facilitates the recording process, minimizes the risk of error, and allows for the definition of data exploitation models. Data exploitation can be automated, making it easier to generate reports and control panels in the form of a dashboard, which in turn allow for quick assessments of the situation. A registered medical record in electronic format makes it possible to establish secure and specific communication between all the professionals who have access to it. Furthermore, it reduces the errors of interpretation specific to oral messages and prevents the

security risks of telephone communications or electronic systems (such as e-mail or WhatsApp), which are overused, even when it comes to the athletes' personal matters.

A medical-based retrospective auditing of the medical record for medical training purposes or by legal request proves more secure and more complete in the event of disputes arising from the electronic recording model of medical records. Transferring information from servers alien to the medical record is especially interesting, but requires the definition of security protocols to make the communication reliable and protect it from gateways which would make the system vulnerable. If communication protocols are not reliable enough, or if the system administrators are not able to ensure such protection, any additional piece of information that comes from abroad and is considered relevant to the medical record should be stored, the image files should be copied, and the original documents should be scanned and saved as pdf files.

Figure 1: Structure of Medical Record



Source: Prepared by the author

The task flow proposed in the previous scheme is a work proposal to store data and images generated by devices belonging to the clinical department itself. Clinical departments possessing analysis, testing and image diagnosis tools are recommended to store the information obtained through such means in the medical record. These data and images must be automatically transferred after they are acquired by the device. Digitalization of older medical records constitutes a costly process, but it prevents loss or deterioration of the recorded information, making it available for the future.

Confidentiality

Related medical acts and records are based on mutual trust between the parties involved. Strict confidentiality is essential to maintaining this trust and is required by the ethical code which governs every professional intervention. Health data touch on individuals' most intimate aspects, so any communication thereon must occur under special authorizations only. On the other hand, it must be ensured that records are sufficiently protected, and that any security access violation is traceable.

Nowadays, most contracts with professional athletes provide that, in the event of injury or any condition that may affect their performance, coaches and team owners receive information on their health situation, in the face of a disease. It is always important, however, to respect the individual and his rights, so it is important to talk with the athlete about his situation and options, to ensure there is a therapeutic plan before contacting the other stakeholders. Of course, any kind of external communication with mass media about an athlete's health must be approved by the latter and, if possible, by the board and coaches. The advisory services provided by the communication department are usually very useful in such situations. It must be noted that athletes may wish to involve other people in disclosing the process. This must be handled carefully and with the assurance that it is done at the patient's request, and that those who receive the information will use it in the athlete's interest. The sports physician must also keep in touch with the other medical professionals involved in the process, as well as with the physiotherapist, the sports coach and the strength and conditioning coach, in order to evaluate the rehabilitation of the player and the discharge to resume competitive performance in order to promote the conditions necessary for the athlete to resume playing. In this case, communication is sensitive and must be very specific, so that entries to the medical record become a reliable communication tool, so long as participants are provided with an appropriate access to the system.

The transfer of data and images is critical when the athlete is injured or treated outside of the normal environment. All that information must be conveyed in an encrypted format so as to ensure confidentiality. Such processes are commonly carried out in other medical disciplines, especially when second opinions are requested.

Specific software

The use of recording systems in hospitals and medical consultations has resulted in different registration models, enabling the management of

agendas and clinical records with greater adaptation and connectivity capacities, as the processes that are addressed and the procedures that are applied become increasingly complex.

The actual needs of a team sports physician in terms of the entries differ significantly from those prevailing in common clinical environments, since recording requirements in clinical medicine need not be as broad or versatile as those in sports medicine. The ideal system for responding to the specific needs of competitive sport should be compatible with the following criteria:

- Offer additional schedules to the medical ones, such as competition and training schedules.
- Many fields of the platforms must be multilingual. Nowadays, teams are no longer comprised of athletes of a single nationality. Registration platforms must take this fact into account in order not to lose reliability, especially when it comes to informed consent documents and subjective evaluation scales. On the other hand, athletes will sometimes have to travel to other countries, and foreign professionals may need to access the information.
- They should have access to the coding systems that are commonly used in sports medicine (OSICS-10).
- In the realm of sports, new assessment and measurement criteria frequently appear, and they need to be incorporated into the system. Therefore, connectivity is essential.
- Each sports discipline is characterized by specific needs and epidemiology, so there must be a possibility for some parts of the system to be hidden or visualized according to those needs.
- The system must also be able to record the individual's parameters that are not directly related to pathological conditions. These are the constraints which can change the ability to adapt to loads, which is the basis of training and which could be used to record risk factors.
- It must be a cross-platform system. Work is increasingly performed near match venue and training grounds, and while traveling. Compatible systems on smart devices offer an accessibility that increases the number of records and the possibilities of data processing.
- Analyses of the data relating to the players' condition and to their actions in the context of work sessions are very useful in decision making. Instant access to these data and analyses proves critical when users analyze software systems.
- Cloud-based platforms using data owned by the user and presenting sufficient security measures to guarantee confidentiality, constitute

one of the best work resources, although this leads to dependency on a system, making it indispensable for future work.

The requirements are manifold, and each organization has its unique necessities. This has led clubs, federations and international organizations to create their own platforms. In this context, the lack of compatibility between systems makes it impossible to compare results. In order to do this, new recording systems must be created. On the other hand, these organizations have a limited capacity for development, which, over time, hinders their evolution or requires a significant financial effort.

If the decision is made to purchase licenses of already marketed systems for medical records and sports monitoring, the investment will be lower, but it will prove more difficult to fully adapt those systems to some specific needs. In this case, users are recommended to ensure the system's security and confidentiality, and to make sure that the software provider remains active and provides the necessary updates. Ideally, users are recommended to establish a direct relationship protocol with the system developers which would allow the user to interact with them so that future developments are related to any needs detected. Every system must be provided with an ample storage capacity. Videos and high resolution medical images require a lot of space. Furthermore, the execution speed of the system should ideally be adequate to allow dynamic work.

Data presentation

Medical records and data recording are an essential part of the medical act. On many occasions, the intellectual process necessary for decision-making is based on record entry. Therefore how the medical record is entered into in the database can be a great help. To get more useful flows, it is important to involve users in the design of these systems and platforms.

Records currently account for an ever-increasing accumulation of data, and images can be digitized and analyzed over again, so that even more data are generated. Although these data constitute the basis for more objective and reliable records, they can become useless if they cannot be exploited. Many people, for the sake of rigor, have striven to accumulate huge amounts of data which have proved useless, with the sole result of exhausting those who, acting in good faith, made the effort to compile said data. It is therefore necessary to plan an usage scheme for records and data at several levels:

- Day-to-day level: creating control panels in which predetermined parameters regarding the current or evolving reality of an individual

process, of a whole team, or part of the athletes conforming one, are observed. These panels must be dynamic and adaptable, so that intermediate users are able to modify them. Some platforms are designed for data analysis and presentation, such as Power BI ©. In competitive sport and in the decision making process relating to injury follow-up, instant access to data and analyses can prove vital.

- Retrospective analysis level: in most situations, the needs and problems which require analysis were not anticipated at the beginning of the data collection process, so the questions are formulated once it is understood that a problem must be addressed. In this case, data must be accessible and the analysis is performed in hindsight, in order to determine whether the nature – and the seriousness – of the problem justify effort involved; and then to identify its causes by searching for its possible correlations with the factors preceding the problem. In doing so, once the elements that relate to a real and significantly important problem which deserves to be worked on have been identified, a proposal to correct them can be initiated. Once these proposals have been implemented, it will be necessary to assess whether the importance or seriousness of the problem has been corrected.
- Data mining level: the amount of data that accumulate around athletes and competitive teams could reasonably justify the use of discretionary analyses, by means of algorithms aimed at identifying correlations between elements and situations that could not have been imagined.

As a result, we should be able to project predictive models that could serve as a basis for true prevention. So far, prevention models have been based on the intuition and good faith of those who propose them, but these factors, which are particularly useful in reactive situations when an injury needs to be diagnosed and treated, are not adequate to reduce the risk of injury. Artificial intelligence could become more effective in developing prevention measures on a more proactive basis.