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Management

A STUDY ON THE FACTORS AFFECTING THE REPORT GENERATION AND PROCESS OF THE COMPREHENSIVE ATHLETE ASSESSMENT IN A SPORTS SCIENCES CENTRE AT A MULTISPECIALITY HOSPITAL IN CHENNAI

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ABSTRACT A Study was done on the factors affecting the report generation and process of a specially designed package "Comprehensive Athlete Assessment" in a premiere Sports Sciences Centre at a multispecialty hospital in Chennai. Study on secondary data was done on all previously completed Comprehensive Athlete Assessments in the Centre. The population study of 7 units-in-charge generating reports included unstructured direct interviews and response to questionnaire and the observational study of 25 athletes who underwent this package during the entire period of study. It was found that the major reason for delay in report generation was the need for a standardized and computerized format (as all the component test reports were compiled) increasing accuracy and decreasing the turnaround time for the report generation process. The Comprehensive Athlete Assessment package was being well accepted and a steady increase the number of athletes for this package seen.

KEYWORDS : Athlete Assessment Tests, Optimum Process Time, Computerized Report Generation, Sport Sciences and Hospital Management.

INTRODUCTION

Sports Education:

Knowledge of the basics of Sports Sciences and understanding of the principles behind modern scientific training of the players will be a huge advantage for trainers and coaches who enhance and shape the career of any sportsperson. This Sports Sciences Centre is partnering with Exercise & Training Academy (ETA), Cape Town, South Africa for providing world class education and training providing authentic Certification for Coaches and Trainers.

Sports Medicine:

At the Sports Medicine division of SRASSC, various levels of athletes (recreational to professional) approach with the goal of returning to the sport that they enjoy playing, both physically fit and mentally improved.

The various services provided in this area are

- Sports physician consultations
- Periodic health assessment of athletes
- Medical management of injuries, illnesses and other conditions
- Advice regarding supplements and medications with respect to doping test concerns
- Therapeutic use exemption certificates
- Immunization and Vaccination
- Prevention of travel and food related medical disorders
- Medical fitness testing and certification regarding recommen dations for rest and return to play
- Medical clearance for exercise and rehab programs during or after injuries and illness
- Procedures like muscle biopsy, intra-articular and intra-lesional injections
- Age assessment.

Comprehensive Sports Assessment

Sports Sciences Centre has developed a comprehensive program for the scientific assessment of sportspersons comparable to the "Master Health Checkup" for the common man. This is tailor made for persons taking part in both competitive as well as leisure sports.

The "Comprehensive Sports Assessment" program includes

- Essential clinical and laboratory tests
- Medical screening by sports physician with relevant investigations if necessary
- Bio-mechanical assessment of players
- Physiological testing for strength, flexibility, agility, endurance etc.
- Musculoskeletal screening for injury assessment and prevention
- Sport skills testing
- Nutritional assessment of diet and supplements
- Anthropometry
- Podiatric testing
- Isokinetic testing
- Psychological assessment and mental conditioning

The Comprehensive Sports Assessment is designed to provide the benefits of both improved performance and injury free career to anyone involved in sporting activities.

This study was done to determine the factors that affect the report generation and process of the Comprehensive Athlete Assessment. All these tests are to be done in the most efficient order so as to enable the athlete to complete the tests in the minimal time to reduce waiting time at the centre and give maximum customer delight. The results from the various individual assessments are collectively gathered and a comprehensive report is generated for the athlete that would indicate his current strengths and weaknesses. Suggestive action may be taken based on this comprehensive report.

Generation of the Comprehensive report and the factors that influence its generation are the focal points in this research study to enable faster turnover time for the report.

Review of Literature

Steven Finkler A., (1993) assessed time and motion analysis to find out the actual time for completing different task. The result of the sample differed by 20 percent or more of the estimated value of eight of the ten activities. It was expected that the standard deviation decreases as the work sampling observations become more frequent William Hogan R. et. al., (1997) reviewed the published studies of data accuracy in Computerized Patient Records. These studies report revealed the high variable levels of accuracy. This variability steam from the differences in study design, in types of data studied and in types of data studied and in the CPRs themselves. Dinesh Seth et.al, (2005) Value stream concepts were used in both current and future states of supplier floor shop scenarios along with TAKT time calculations and the application of other gap areas. Gain in production output per person, reduction of work-in-progress and finished goods inventory affecting productivity were finally reported. Michael E Matheny et.al., (2005) have studied the impact of physician's use of a tests results management tool embedded in an electronic health record on patient satisfaction with test communication. A prospective controlled trial of 570 patient encounters in 26 outpatient primary care practices was conducted using cluster-randomized sampling method between December 1, 2002 and April 30, 2005. Patient satisfaction telephonic surveys were collected before and after the intervention in both arms. The survey response rate was 74.2% (570/768). Patient satisfaction was increased significantly due to intervention (test results communication (odds ratio 2.35, 95% confidence level, 1.05-5.25, p = 0.02). Thus patient satisfaction has improved based on the automated test results management system. Zoe Radnor, et.al, (2008) have done a literature review on Business process improvements in the public sector in the United Kingdom. Lean, Six Sigma, BPR and Kaizen concepts have

been applied across a number of services. The review showed 51% focused on lean and 35% considered Health services. Lean plays an important role in public service and business process improvement. Various tools and approached have been used that included Lean production, flow, rapid improvement events (RIEs), process and value stream mapping, standardizing systems and root cause analysis in hospitals to improve emergency care , operating units and intensive care units and to reduce waiting times. It was "easier" to recognize and remove forms of waste by using process for the first time.

Preetinder Singh Gill (2012) has done a review of existing literature pertaining to the application of Value Stream Mapping tool in hospital emergency rooms/departments. The potential benefits emanating from the application of VSM where it has already been implemented has been discussed. Furthermore, the assessment of its effectiveness and the challenges faced in the implementation of the VSM tools were collated. Various solutions to address these challenges have been presented in the scenario of the tribulations faced by today's health care industry.

Coorevits P. (2013) has done a study on new opportunities for clinical research on Electronic Health Records. In that study he observed that the EHR is used for clinical routine care which had some limitations at present. Based on new improved systems were developed to use RHRs for secondary purpose. EHRs can be used for secondary purposes based on new improved systems. Design and execution of clinical trials for new medicine is possible in clinical research. HER system can be enabled the use of clinically validated information structure.

Hersh W.R. and Gorman P.N. (2014) have done a study on scope of information retrieval and Electronic Health Record use. In the study they observed that the physicians of the current century interacted in diverse ways with information systems requiring competence in many aspects of clinical informatics. However this omits the growing number of other ways that the physicians are interacting with information that includes activities such as clinical decision support, quality measurement and improvement, personal health records, telemedicine and personalized medicine. A process was devised with numbers representing different perspectives. This defined competencies in clinical informatics for a curriculum transformation process. From the broad competencies, specific learning objectives and milestones, an implementation schedule, and mapping to general competency domains were developed.

Need for the study:

The research study will help understand the current process flow, map the process and arrive at a most efficient process timing of tests. The research study will also help understand the various factors that influence the generation of the comprehensive athlete assessment report and find solutions to implement resulting in reduction in the turnover time for report generation to enhance customer satisfaction and improving the image of the facility.

This would also help in increasing the accuracy of the reports generated. This would enable the athlete to have access to his reports as early as possible to commence on appropriate suggestions as given by the experts in the various areas of assessments.

Objective of the Study:

a) Primary Objective:

- To study the existing process flow and report generation pattern for the various comprehensive assessment tests done on athletes and identify the factors affecting report generation time

b) Secondary Objective:

- To identify the possibility to integrate report generation of the various tests
- To study the possibility of reduction in overall time taken to generate the reports
- To analyse the process flow patterns, timings and other data collected.
- To give suggestion on the overall package to enhance customer delight.

Research Methodology:

The research is to study the processes and various factors that affect the report generation process of the Comprehensive Athlete Assessment tests done in Sport Sciences Centre of a multi specialty hospital, Chennai. This is descriptive study of the various test processes and includes a structured feedback in the form of a questionnaire from all the seven heads of each process in the Comprehensive athlete assessment that generates a report in order to provide a consolidated assessment report for every athlete in the various sporting categories. Direct interviewing of the personnel was also taken into consideration while arriving at the optimum process flow of tests. The observation technique also used in this study i.e the Overt Observational method. Overt observational research is the approach will create the environment that the respondents may modify their behavior due to the researcher identify themselves as researchers and explain the need of their observation. The reason of modifying behavior is the respondents know that they are being watched, so they may portray their "ideal self" rather than their true self. The advantage that the overt approach is that there is no deception. An interview technique used to transfer the information from interviewee to interviewer. The structured feedback from the various heads gives data required for assessing problems faced during report generation.

Observation of the various processes done on the athletes during assessment provided data for analysis on process timings and process flow. Collection of the structured questionnaire provided the necessary data require assessing the needs of the report generation from the different processes in the Comprehensive Athlete Assessment. The previously completed Comprehensive Athlete Assessments provided the secondary data and the available findings reported have been used in this research study. The period of study was a period of three months, i.e., from February 1, 2016 to April 30, 2016. The study covered the population of all the Comprehensive Athlete assessments done during the period of study and prior completed assessments for which data was available and population study of all the heads of departments generating reports for the Comprehensive Athlete Assessment. A structure questionnaire was distributed to all 7 units-in-charge generating reports for the 12 tests constituting the Comprehensive Athlete Assessment (Population Study) and their feedback was analyzed. An informal interview was also done to get information regarding the various processes and factors that affected report generation process.

RESULTS AND DISCUSSION

Primary data showed that male athletes have undergone the Comprehensive Athlete Assessment test to a larger extent than females (87% and 13%). The maximum numbers of athletes that have taken this package are Cricketers followed by Athletics and swimmers during the period of study.

From the respondents of the questionnaire it was found that:

- 85% of the tests were scheduled between 24 to 48 hours in advance. Hence it is possible to plan the work schedule of the staff accordingly.
- 85.7% of the respondents agreed that the assessments started as per the scheduled time and this did not influence overall generation of reports.
- All the respondents agree that the major cause for delay in start of process is the delay in completion of previous process.
- The generation of reports is done according to the convenience of the assessor (43%) and essentially according to need of the time of output totaling around 71.5%.
- There were some processes that were able to generate reports on time while others found it difficult to do so. This is due to the reason that some reports carry only automated readings from instruments while others require interpretation of expert along with results causing delay in report generation.
- 50% of the respondents believed that the major reason for delay is the amount of paper work and non-standardization of the format of the report. All other causes contributed to the remaining 50% of the reasons.
- 85% respondents agreed that the reports generated by each process are independent of the reports generated by other processes. Hence cause for delay is not dependant on other processes.
- They were expressed the need for a single point of co-ordination of all the reports to enable quicker generation of the comprehensive report by over 71% of the respondents.
- Unanimously, all respondents agreed that standardization of format was essential to enable quicker completion of the final and consolidated report. The process has been initiated and this would enable a standard format resulting in speeding up of the entire process of report generation.

- The researcher observed 25 athletes (entire population during the study period between 01/02/2016 and 30/04/2016) and recorded the following data. Based on the observations and detailed unstructured interviews, the researcher analyzed the information gathered.

Table 1: Duration of Tests in Minutes

Player Number	Lab/ X-ray/ ECG 1	Medical& cl. podiatry 2	MSK test 3	Inst. podiarty 4	Sports Nutrition Ass. 5	Anthropometry 7	Isokinetic tests 9	FMS 10	HP tests 11	3-D Biomech 12
Player 1	50	55	40	25	35	10	50	30	60	not done
Player 2	85	70	35	25	35	15	40	25	50	not done
Player 3	40	45	45	50	30	10	40	20	55	not done
Player 4	90	100	30	25	50	10	30	20	65	not done
Player 5	85	45	25	35	30	10	40	30	90	not done
Player 6	85	30	25	30	60	10	40	25	105	not done
Player 7	85	55	40	25	30	10	45	30	90	not done
Player 8	55	70	30	30	30	10	60	30	105	35
Player 9	55	75	35	35	35	10	60	35	90	70
Player 10	55	55	40	25	40	10	50	25	105	70
Player 11	50	50	35	25	45	15	45	25	90	45
Player 12	50	40	35	30	40	10	40	25	105	45
Player 13	40	40	35	30	35	10	45	20	90	not done
Player 14	40	40	30	35	30	10	45	25	90	not done
Player 15	40	45	40	35	35	15	45	20	105	not done
Player 16	55	60	30	40	35	10	50	25	90	45
Player 17	55	50	30	35	40	15	50	20	105	30
Player 18	70	30	30	40	40	15	45	20	90	55
Player 19	70	45	25	35	35	10	45	20	105	55
Player 20	55	50	30	40	30	10	45	25	85	50
Player 21	60	45	40	25	30	5	45	15	90	45
Player 22	45	50	30	25	30	5	30	15	90	55
Player 23	55	45	40	15	30	5	45	15	105	75
Player 24	85	25	45	20	30	10	45	20	105	not done
Player 25	85	75	40	15	25	10	30	15	105	not done
AVERAGE	**61.6**	**51.6**	**34.4**	**30.7**	**35.4**	**10.7**	**44.7**	**23**	**90.6**	**51.2**

Table 1 shows that the tests were ranked in order of time duration necessary to complete the various tests that constituted the Comprehensive Athlete Assessment, the above table shows that the maximum time necessary is for the high performance tests. The test ranked second was the Laboratory tests/ X-ray and ECG done in the hospital that has a mean duration of 61.6 minutes. This will help the athlete to be prepared for the maximum test timing amongst the various tests that he would be undergoing. The deviation from the standard duration was maximum for the High Performance tests. This is expected as the athletes from the different sporting events would have a different set of tests to assess their performance and thus can be compared to the fitness of those athletes amongst the best in the same sport in National and International platforms.

Table 2: Rank Analysis based on Mean & Standard Deviation time of tests

NAME OF TEST	MEAN TIME IN MINUTES	STANDARD DEVIATION IN MINUTES	RANK
Laboratory tests/ X-ray / ECG	61.6	17.2	2
Medicals/ Clinical Podiatry	51.6	16.5	4
Musculo-skeletal screening	34.4	6.1	9
Instrumental Podiatry	30.7	8.2	10
Sports Nutrition	35.4	7.3	8
VO2max	39.2	7.5	7
Anthropometry	10.7	2.9	12
Sports Psychology	53.8	17.6	3
Isokinetic Test	44.8	7.3	6
Functional Movement screening	23	5.4	11
High Performance Tests	90.6	41.2	1
3-D Biomechanics	51.2	13.6	5

Table 3: Duration for Report Generation

PLAYER NO.	SPORT	AGE/GENDER	DATE OF TEST	REPORT ISSUAL DATE	DURATION IN DAYS as on 30/4/16
1	Tennis	15/M	12/2/16	26/02/16	13
2	Cricket	17/M	2/17/16	26/02/16	7
3	Tennis	16/M	19/2/16	10/03/16	18
4	Hockey	26/M	29/2/16	06/03/16	5
5	Badminton	16/M	29/3/16	16/04/16	16
6	Badminton	15/M	29/3/16	16/04/16	16
7	Badminton	16/M	29/3/16	16/04/16	16
8	Cricket	15/M	4/4/16		Pending
9	Cricket	15/M	4/4/16		Pending
10	Cricket	15/M	4/4/16		Pending
11	Cricket	17/M	7/4/16	30/04/16	21
12	Cricket	18/M	7/4/16	30/04/16	21
13	Athletics	13/M	15/4/16		Pending
14	Athletics	15/F	15/4/16		Pending
15	Athletics	13/F	15/4/16		Pending
16	Cricket	19/M	17/4/16		Pending
17	Cricket	30/M	18/4/16		Pending
18	Cricket	23/M	21/4/16		Pending
19	Cricket	20/M	21/4/16		Pending
20	Cricket	21/M	25/4/16		Pending
21	Cricket	24/M	4/28/16		Pending
22	Cricket	22/M	4/28/16		Pending
23	Tennis	17/M	4/27/16		Pending
24	Tennis	15/M	4/27/16		Pending
25	Tennis	18/M	4/27/16		Pending

Table 3 displays the total time taken to generate a Comprehensive Assessment report. The maximum duration taken for completed reports was 21 days and the minimum time that it was generated was 5 days. Average time take for the 9 reports generated was 15 days. There were 3 reports pending for more than 26 days, 3 for over 15 days, remaining over 10 days. This indicated that completion of reports was pending greater than 15 days that was the average time taken for reports completion during the observational period of the researcher. The reason for pending reports was situation based and unexpected flow of athletes for various tests.

Table 4: Evaluation of expected time of completion of tests DAY 1 based on Project Evaluation Review Technique (PERT)-1

Activity	Process Name	Minimum time T_{Min} in minutes	Maximum time T_{Max} in minutes	Average time T_{AVG} in minutes	Expected time T_{Exp} in minutes $T_{EXP} = \frac{T_{MIN} + T_{MAX} + 4\,T_{AVG}}{6}$ in minutes
1.	Registration/Orientation	5	15	10	10
2.	Laboratory tests/ Xray/ ECG	40	90	62	63
3.	Breakfast	15	30	30	27.5
4.	Medicals/ Clinical podiatry	25	100	20	30
5.	Musculo-skeletal test	25	45	34.6	34.7
6.	Sports Nutrition	25	60	33.3	36.4
7.	Lunch	40	90	60	61.7
8.	Instrumental Podiatry	15	50	30.2	30.97
9.	VO_{2max}	25	60	38.6	39.9
	TOTAL TIME				241.5

Critical Path 1-2-3-4-5-6-7-8-9 241.5 minutes

Total estimated time for all activities on day 1 is 241.5 minutes or 4 hours (approx.)

FIGURE1: DAY ONE OF COMPREHENSIVE ATHLETE ASSESSMENT

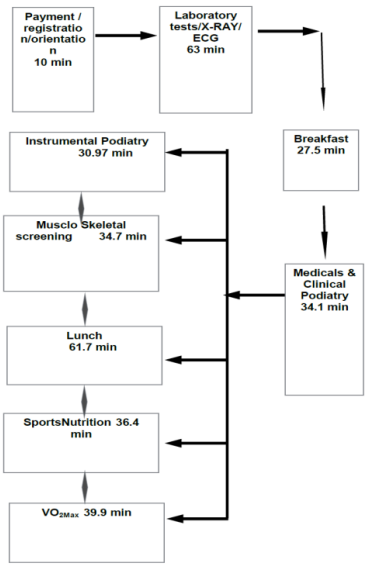
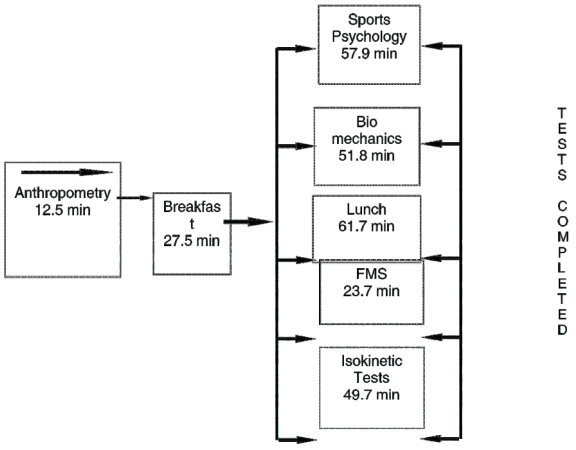


FIGURE 2: DAY TWO OF COMPREHENSIVE ATHLETE ASSESSMENT



Activity 1 Anthropometry 12.5 minutes
Activity 2 Breakfast 27.5 minutes
Activity 3 Sports Psychology 57.9 minutes
Activity 4 Bio-Mechanics 51.8 minutes
Activity 5 Lunch 61.7 minutes
Activity 6 Functional Muscle movement tests 23.7 minutes
Activity 7 Isokinetic Tests 49.7 minutes

Total estimated time for all activities on day 2 is 284.8 minutes.

Table 5 Evaluation of expected time of completion of tests based on Project Evaluation Review Technique (PERT)

Process Name	**Minimum time T_{Min}** in minutes	**Maximum time T_{Max}** in minutes	**Average Time T_{AVG} in** minutes	**Expected time T_{Exp} in minutes** $T_{EXP} = \frac{T_{MIN} + T_{MAX} + 4\ T_{AVG}}{6}$
High Performance tests	50	105	90.6	86.2
Total Time for day 3				86.2

The results shows the total time that an athlete is expected to spend at the centre for undergoing the Comprehensive Athlete Assessment tests.

The athlete would be expected to spend 241.5 minutes at SRASSC on day 1.
The athlete would be expected to spend 284.8 minutes at SRASSC on day 2.
The athlete would be expected to spend 86.2 minutes at SRASSC on day 3.

FIGURE 3: WHY-WHY DIAGRAM

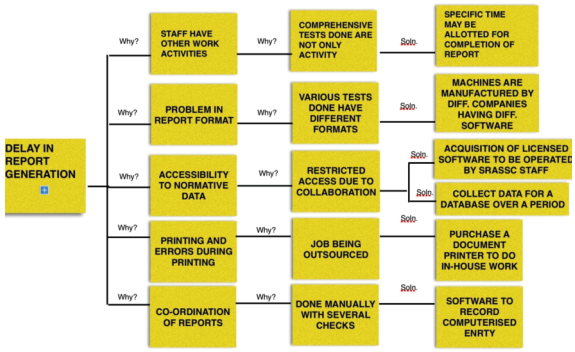


Figure 3 projects that the why-why diagram is another descriptive method that was used to give a pictorial depiction of the factors that contributed to delay in report generation. This information was gathered as a feedback from the seven units-in-charge and was duly analyzed and depicted.

FIGURE 4: FISH BONE ANALYSIS

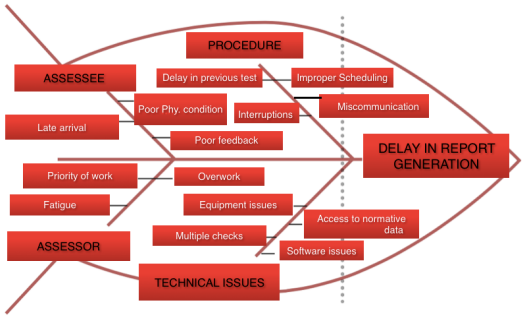


Figure 5 shows that researchers made an attempt to explain the causes of delay in report generation through fish bone diagram. The fishbone analysis gave a bird's eye view of the delay in report generation based on the assessor (the doctor/technician doing the test), the athlete undergoing the test, procedural delays and technical issues causing an overall delay. Thus multiple factors as observed by the researcher resulted in overall delay

Findings on the Test process:

The following findings are based on the data collected during the research period.

- The orientation of the Comprehensive Athlete Assessment by the authorized person was done orally.
- There were more males than females who took this assessment. The percentage of males was 87 while that of females was 13.
- There were athletes from different sports who undertook the assessment. Out of the 25 athletes who underwent the assessment the maximum number of athletes were from the sport cricket (13) followed by athletics and swimming (6) and (5) respectively.
- The maximum time taken was for the High performance tests (90.6 minutes). These were the only set of tests that showed excess of average time taken for conducting the test over the scientifically estimated time with the help of PERT technique by 4.4 minutes. The reason for this was due to the fact that the high performance tests showed a large variation in time because of the individual performing the test and the genre of sport that he pursues. Test processes did not have any large delays.

Findings on observational Study:

- The average time taken for generating reports was over 15 days.
- Report generation was possible in 5 days on an urgent basis.

Findings from Interviews with the persons generating the reports:

- Through direct interviews, the researcher understood that various

test reports had different ways of generation and different formats.
- Place of storage of the different reports were not the same.
- Consolidation of reports were being done by copying each report manually inserted into a standard format that was required to be given to the athlete.
- Some reports had short process of completion while other had longer timing.
- Access to normative data for comparison was restricted to one person only.
- Reports had to be verified and checked manually before being dispatched.
- Most of the Comprehensive Athlete Assessment Reports could not be completed due to delay in one or two reports.
- Reports were being generated according to need basis.
- Turnaround time (TAT) for report completion for every station (every test process) was fixed for 48 hours. However, this was not being achieved by every station.
- Compilation of data was being done and checked manually by authorized person.
- Time lag was noticed for this process but could not be calculated as reports were being done in parts at the convenience of the assessor.

Recommendations:

The researcher has studied the process and report generation process of the Comprehensive Athlete Assessment package. The following suggestions have been made on the basis of Primary data collected through Observational study, direct unstructured interview and response to the questionnaire given to them, and through Secondary data available with the centre.

- The estimated duration for the completion of each test has been calculated and this may be used as the optimum time to complete the process. Any substantial deviation may be duly reported with reasons to audit the process completion timings.
- Record completion can be made more efficient and accurate with standardization of report formats and introduction of software for data capture.
- A pretest information email detailing the process and requirements from the athletes can be formulated and sent as soon as the appointment is made and can be automated to send in reminders the previous day to eliminate the lack of communication between the athlete and the doctor.
- Marketing the 'Comprehensive Athlete Assessment package" can be undertaken with the sports bodies at the National, State and District levels and local sport clubs to create awareness about this new and attractive introduction at a very affordable price.
- Identification of new market segments and promotion of test among women athletes would bring a whole new segment of clients as a deduction from male female percentage analysis.
- Creating awareness of the Comprehensive Athlete assessment package can be promoted amongst persons pursuing leisure sports to highlight importance of preventative injury.
- Sport-wise categorization and recording of data will generate a data base on athletes providing material for teaching and research.
- Purchase of licensed software will give access to normative data of all sports persons and speeding up the report generation process, (by elimination of manual checks for data entry), would improve the image of the centre.
- The orientation given to the athletes can be conveyed with the help of visual aids. An orientation chart has been suggested that gives the various components of the Comprehensive Athlete assessment and a second detailing the highlights of each test.
- Modification of the data that is being recorded in the activity sheet has been suggested by the researcher to enable maintenance of a detailed record and this activity sheet has been incorporated.
- A customer feedback form has been suggested in order to get the feedback and improve the services provided at the centre.

Managerial Implications

The researcher has undertaken a study on the Comprehensive Athlete Assessment in a multispeciality hospital, Chennai which is one of the largest sports testing facility in all of Asia, offers this unique package to athletes from both competitive and leisure sportspersons. This study was an attempt made for the first time by a researcher from the faculty of health science management. The period of study was for 90 days from February to April 2016. It has been found that the Comprehensive Athlete Assessment package has been successfully implemented and received well by Athletes from various sporting events. A steady increase in the number of athletes has been observed since its inception. The researcher has suggested Orientation Posters to enable the athletes to easily understand the various tests conducted and its relevance with the help of the visual aids.

The process flow has been consistently improved and optimized over a period of time by trial and error and according to the convenience and availability of the assessor in order to complete the tests scheduled for every single day. The estimated time for each process constituting the Comprehensive Athlete Assessment has been calculated in this study that can be used to audit any delay in process duration. Maintenance of Activity Sheets and enhancement of data collection (data quality) was suggested. Need for a software being installed for purpose of accuracy and quicker completion of reports has been identified and implementation of the same has been initiated. The turnaround time for process of report generation has to be decreased for which the software would be of vital importance. This would increase efficiency and add to the image of the hospital.

It is essential to cater to athletes at both National as well as the International levels. Hence a Customer Feed Back form was suggested to enable the centre to achieve the status "Customer Delight".

Conclusion

In conclusion, the Comprehensive Athlete Assessment package is the "star package" that attracts athletes from various sporting events from different parts of the country for its uniqueness and pricing and hence due importance may be given to enhance both process efficiency and report generation speed.

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