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doi:10.29503/RLSH.201112.0004

休閒運動健康評論, 3(1), 2011

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頁數/Page： 44-57

出版日期/Publication Date：2011/12

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休閒運動健康評論(ISSN 2218-0427)
第三卷第一期
中華民國一百年十二月

Review of Leisure , Sport and Health (ISSN 2218-0427)
Vol.3 No.1
December, 2011

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高爾夫揮桿技能與比賽表現相關性分析

梁俊煌[1*]、施正人[2]、王明瑞[3]

[摘要] 本研究主要是希望瞭解 2010 年 PGA 高爾夫選手揮桿技能與比賽表現相關性分析。研究自變相計有高爾夫技能如開球距離、開球準確度、攻上果嶺機率、果嶺邊回救能力等，依變相則有選手比賽成績如 1 最後一回合成績、2.擊出低標準桿機率、3.四桿洞成績、4.上果嶺博蒂機率、5.每回合成績、6.四桿洞博蒂機率、7.五桿洞成績、8.三桿洞成績、9.第三回合成績、10.老鷹(回合數)、11.博蒂機率、12.五桿洞博蒂機率等。研究中以線性多元迴歸進行選手擊球技能與比賽成績表現相關性分析，α= .05 爲顯著考驗水準。

結果: 1.開球距離分別與擊出低標準桿機率($t = 3.940$, $p < .01$)、五桿洞成績($t = 2.589$, $p < .05$)、及三桿洞成績($t = 3.627$, $p < .01$)呈正相關。2.開球距離卻與四桿洞博蒂機率($t = -3.169$, $p < .01$)、及老鷹($t = -2.291$, $p < .05$)呈現負相關。3.開球準確度與四桿洞博蒂機率呈正相關($t = 2.110$, $p < .05$)。5.攻上果嶺機率與擊出低標準桿機率($t = 7.006$, $p < .01$), 及老鷹($t = 2.964$, $p < .01$) 呈正相關。5.攻上果嶺機率與上果嶺博蒂機率呈負相關($t = -11.610$, $p < .01$)。6. 果嶺邊回救能力分別與四桿洞成績($t = -2.466$, $p < .05$)及四桿洞博蒂機率($t = -2.466$, $p < .05$), and Par 4 Birdie % ($t = -3.097$, $p < .01$). 7)呈負相關。7. 果嶺邊回救能力與上果嶺博蒂機率呈正相關($t = 2.021$, $p < .05$)。

建議:綜合上述所得結果，爲讓選手成績更好，教練可增加選手肌力與力量訓練，以利提升選手擊球距離。同時、強化選手解決問題能力、心理強悍度、提高選手擊球控制能力，增加擊球精準度。如此定能讓選手擊出更好的成績。

關鍵詞：Driving Distance, Greens in Regulation Percentage, Scrambling.

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I.INTRODUCTION

Golf is a very demanding physical game, not only in terms of precision and complexity of the golf swing movement, but also in terms of explosive power through a wide range of motion. Golf has been considered as a skill-based sport in which the continual refinement of ball striking and putting skills is emphasized over the development of kinanthropometric (anthropometric and physical fitness) qualities (Keogh, 2009). McHardy (2005) described the golf swing as a complex movement of the whole body that transfers power to a golf ball to propel the ball great distances with accuracy. Fradkin and colleagues (2004) indicated that clubhead velocity has been shown to connection with golf handicap. On the other hand, Hale (1990) demonstrated that driving distance is correlated to performance on the American Professional Golfer Association (PGA) tour.

Wells (2009) stated that physiological factors revealed significant correlation with golf performance in elite golfers. For example, significant associations were noted between in anterior abdominal muscle endurance and driver carry distance ($r = .38$; $p = 0.04$) and average putt distance after a chip shot ($r = -0.44$; $p = 0.03$). McCaffrey (1989) described that elite golfers committed to golf, have goals they strive for, evaluate their performance, make plans and consciously train towards improving their game. Elite players also believe that attitude, desire and motivation are important psychological qualities necessary to succeed in tournaments (Douglas, 2002). Newell and James (2008) stated that, the amount of variability in the movement outcome is inversely related to the amount of variability in the underlying movement dynamics that produce outcome. Bradshaw et al (2009) described that golfers seek to learn a variety of movement solutions rather than attempt to develop absolute invariance in golf swings over repeated performance trails, presumably to facilitate more reliable performance when confronted by fluctuations of internal and external

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factors.

Apparently, a lot of golfers wonder why there is a lack of improvement from year to year. Noel (1999) suggested that the first item was to set a challenging and measurable goal, and then reach the goal. The training goal should include physical fitness, a strategy, and improvement of putting. Strange and Anderson (1996) indicated that players not swing before examining all options. Stand directly behind the ball and weigh the risk and reward for every possible shot. The six choices are: over, under, hook, slice, through an opening, or pitch to the fairway. They suggested that if you are down in a match, you probably have to take a bigger risk. At stroke play you are wise to play more conservatively and minimize your chances of making a big number.

A.Purpose of Research

The primary purpose of this study was to determine the effects of subjects' swing skill on tournament performance in 2010 PGA Tour. The research questions are:

a.What are the correlations between golf swing skill and performance in PGA Tour?

B.Definition of Terms

The following terms were defined in relation to their use in this study. Terms without citation were developed a priori.

Scrambling: This is the percent of time that a player misses the green in regulation, but still makes par or better.

Birdie Conversion %: This is the percent of time a player makes a birdie after hitting the green in regulation.

Par Breakers: This is the percent of the time a player is under par for a hole.

II.METHODS

A.Population and Sample

This study consisted of the top 100 players of the money prize on the 2010 PGA Tour. The statistical information for the top 100 player's performance was collected from the United State Golf Association (www.pgatour.com).

a.Swing skill

All subjects' swing skill defined as independent variables, which were assessed swing performance in PGA Tour: Driving Distance, Driving

Accuracy, Greens in Regulation Percentage (GIRP), Scrambling. The basic independent variables of the subjects' swing skill were listed in Table 1.

Table1 Basic independent variables of the subjects' swing skill

	Mean	SD
Driving Distance (yards)	275.15	6.66
Driving Accuracy (%)	0.70	0.01
GIRP (%)	0.67	0.03
Scrambling (%)	0.60	0.04

B.Tour Performance

All subject's performance defined as dependent variables, which were recorded by PGA Tour performance such as 1.Scoring Average Final Round (SAFR), 2. Par Breakers, 3. Par 4 Performance, 4. Birdie Conversion %, 5. Scoring Average, 6. Par 4 Birdie %, 7. Par 5 Performance, 8. Par 3 Performance, 9. Scoring Average 3rd Round (SA3R), 10. Eagles, 11. Birdie Average, 12. Par 5 Birdie Percentage (P5BP). The basic dependent variables of the subjects' swing skill were listed in Table 2.

Table2 Basic Dependent variables of the subjects' performance

	Mean	SD
SAFR (Rounds)	70.66	0.82
Par Breakers %	0.21	0.01
Par 4 Performance	+19.80	28.90
Birdie Conversion %	0.30	0.02
Scoring Average	70.66	0.53
Par 4 Birdie %	0.16	0.02
Par 5 Performance	-103.96	25.54
Par 3 Performance	+13.93	13.12
SA3R	70.52	0.71
Eagles (Rounds)	2.98	1.97
Birdie Average	3.68	0.33
P5BP	0.39	0.06

C.Data Analysis

The SPSS Regression was used to determine the correlation between the dependant and independent variables. The .05 level of significant will be used for all Regression.

III.RESULTS

A.Driving Distance

The Regression indicated that Driving Distance revealed significant positive linear relationship with Par Breakers (t = 3.940, p < .01), Par 5 Performance (t = 2.589, p < .05), and Par 3 Performance (t = 3.627, p < .01) (Table 4). On the other hand, Driving Distance showed significant negative linear relationship with Par 4 Birdie % (t = -3.169, p < .01), and Eagles (t = -2.291, p < .05). There was no significant relationship between in Driving Distance between the tournament performance in SAFR, Par 4 performance, Birdie Conversion %, Scoring Average, SA3R, Birdie Average, and P5BP.

Table3 Model Driving Distance estimated results

Model	Coefficient	t-value	Sig
Constant	413.77	1.69*	0.10
SAFR	-62.92	-0.83	0.41
Par Breakers	459.29	3.94**	0.00
Par 4 Performance	-0.02	-0.42	0.68
Birdie Conversion %	-67.57	-1.24	0.22
Scoring Average	-71.84	-0.21	0.83
Par 4 Birdie %	-269.61	-3.17**	0.00
Par 5 Performance	0.08	2.59*	0.01
Par 3 Performance	0.21	3.63**	0.00
SA3R	-99.28	-1.00	0.32
Eagles	-0.01	-2.29*	0.02
Birdie Average	-0.20	-0.07	0.95
P5BP	11.81	0.75	0.46

*p <.05 **p<.01

B.Driving Accuracy

The model Driving Accuracy estimated results are provided in Table 5. The Regression indicated a significant positive linear relationship exists between Driving Accuracy and Par 4 birdie % ($t = 2.110$, $p < .05$). In addition, no significant were shown in Driving Accuracy between the player's performance in SAFR, Par Breakers, Par 4 Performance, Birdie Conversion %, Scoring Average, Par 5 Performance, Par 3 Performance, SA3R, Eagles, Birdie Average, P5BP. Figure 6 depicted the relationship between Driving accuracy and Par 4 Birdie %.

Table4 Model Driving Accuracy estimated results

Model	Coefficient	t-value	Sig
Constant	3.56	1.83	0.07
SAFR	0.41	0.67	0.51
Par Breakers	-1.18	-1.28	0.21
Par 4 Performance	0.00	0.80	0.43
Birdie Conversion %	-0.12	-0.27	0.79
Scoring Average	-5.05	-1.87	0.07
Par 4 Birdie %	1.43	2.11*	0.04
Par 5 Performance	0.00	-1.21	0.23
Par 3 Performance	-0.00	-1.31	0.20
SA3R	0.84	1.06	0.29
Eagles	4.071E-05	1.80	0.08
Birdie Average	-.040	-1.80	0.08
P5BP	-.050	-0.04	0.69

*p <.05 **p<.01

C.Greens in Regulation Percentage (GIRP)

The model Greens in Regulation Percentage (GIRP) estimated results are provided in Table 6. The regression demonstrated that a significant positive linear relationship exists between GIRP and Par Breaker ($t = 7.006$, $p < .01$), and Eagles ($t = 2.964$, $p < .01$). Apparently, GIRP also indicated negative linear connection with Birdie Conversion % ($t = -11.610$, $p < .01$). There were no significant correlation between GIRP and player's performance in Scoring

Average Final Round (SAFR), Par 4 Performance, Scoring Average, Par 4 Birdie %, Par 5 Performance, Par 3 Performance, Scoring Average 3rd Round (SA3R), Birdie Average, Par 5 Birdie Percentage (P5BP).

Table5 Model Greens in Regulation Percentage (GIRP) estimated results

Model	Coefficient	t-value	Sig
Constant	1.49	2.47*	0.02
SAFR	0.12	0.66	0.51
Par Breakers	2.01	7.01**	0.00
Par 4 Performance	0.00	1.10	0.27
Birdie Conversion %	-1.56	-11.61**	0.00
Scoring Average	-1.26	-1.62	0.11
Par 4 Birdie %	0.30	1.42	0.16
Par 5 Performance	-7.95E	-1.04	0.30
Par 3 Performance	0.00	-1.36	0.18
SA3R	0.07	0.30	0.77
Eagles	2.07E	2.96**	0.00
Birdie Average	-0.00	-0.14	0.89
P5BP	-0.00	-0.05	0.96

*p <.05 **p<.01

D.Scrambling

The model Scrambling estimated results provided in Table 7. The regression revealed that a negative linear correlation between Scrambling and Par 4 Performance ($t = -2.466$, $p < .05$), and Par 4 Birdie % ($t = -3.097$, $p < .01$). Meanwhile, Scrambling also demonstrated a positive linear relationship with Birdie Conversion % ($t = 2.021$, $p < .05$). There were no significant correlation between Scrambling and player's performance in Scoring Average Final Round (SAFR), Par Breakers, Scoring Average, Par 5 Performance, Par 3 Performance, Scoring Average 3rd Round (SA3R), Eagles, Birdie Average, Par 5 Birdie Percentage (P5BP).

Table6 Model Scrambling estimated results

Model	Coefficient	t-value	Sig
Constant	3.62	2.05*	0.04
SAFR	-0.44	-0.80	0.43
Par Breakers	-1.32	-1.57	0.12
Par 4 Performance	-0.00	-2.47*	0.02
Birdie Conversion %	0.80	2.02*	0.05
Scoring Average	-2.38	-0.97	0.33
Par 4 Birdie %	-1.90	-3.10**	0.00
Par 5 Performance	0.00	-1.70	0.09
Par 3 Performance	0.00	-.57	0.57
SA3R	-0.98	-1.37	0.18
Eagles	1.22E	0.59	0.55
Birdie Average	0.01	0.53	0.60
P5BP	-0.11	-0.99	0.32

*p <.05 **p<.01

IV.DISCUSSION

The Regression indicated that Driving Distance revealed significant positive linear relationship with Par Breakers ($t = 3.940$, $p < .01$), Par 5 Performance ($t = 2.589$, $p < .05$), and Par 3 Performance ($t = 3.627$, $p < .01$). Results of this study indicated that players with good driving distance demonstrated good performance in Par Breakers, Par 5 Performance, and Par 3 Performance. On the other hand, Driving Distance showed significant negative linear relationship with Par 4 Birdie % ($t = -3.169$, $p < .01$), and Eagles ($t = -2.291$, $p < .05$). However, good driving distance players did not show great performance in Par 4 Birdie %. These results might be influenced by players missing the fairway and their ball landing in improper area such as rough areas, sand traps or wood. In fact, players with long driving distance had fewer rounds to make an Eagle. There was no significant relationship between in Driving Distance between the tournament performance in SAFR, Par 4 performance, Birdie Conversion %, Scoring Average, SA3R, Birdie Average, and P5BP.

In general, golf requires a player to be

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both strong and flexible. A lot of elite golf players consider muscle strengthening and muscular endurance to be the most important components of an exercise program, because long driving distances could decrease the distance to flag for following shot. Using short iron can help players feel more comfortable, and increase on Green in Regulation Percentage. Reed (2005) stated that the lager arc of the golf swing allows for a greater distance for the golfer to build club head speed. This increased club head speed at direct impact with the ball in combination with additional trunk rotation. Wiren (1990) suggested that players can increase club head velocity, centeredness of contact, length of arc, left wrist position, type of grip, wrist position to enhance driving distance and accuracy. Clah (2006) indicated that the top golfers are now clearly able to push their bodies through maximum load of efficiency and body control that is required to play the sport over an extended of time.

The Regression indicated a significant positive linear relationship existing between Driving Accuracy and Par 4 birdie % ($t = 2.110$, $p < .05$). In addition, no significant correlations were shown in Driving Accuracy between the player's performance in SAFR, Par Breakers, Par 4 Performance, Birdie Conversion %, Scoring Average, Par 5 Performance, Par 3 Performance, SA3R, Eagles, Birdie Average, and P5BP. Finding of Driving Accuracy indicated that higher percentage in Driving Accuracy could increase the players to make more birdie especially in Par 4 hole. This result was supported by Carlton, Chow & Shim (2006). They addressed that the timing precision required to project the golf ball accurately across large distances to the green is high. In competition, the player's golf score can be greatly influenced by one bad shot or by a round with high performance variability.

The regression demonstrated that a significant positive linear relationship exists between GIRP and Par Breaker ($t = 7.006$, $p < .01$), and Eagles ($t = 2.964$, $p < .01$). Apparently, GIRP also indicated negative linear connection with Birdie Conversion % ($t = -11.610$, $p < .01$). There were no significant

correlation between GIRP and player's performance in Scoring Average Final Round (SAFR), Par 4 Performance, Scoring Average, Par 4 Birdie %, Par 5 Performance, Par 3 Performance, Scoring Average 3rd Round (SA3R), Birdie Average, Par 5 Birdie Percentage (P5BP).

Results of this study demonstrated that high percentage on green in regulation could enhance player's score in Par Breaker and make more Eagles. Apparently, a nice golf swing enhanced players' performance, and perfect swing need to combine with clubhead velocity, lunch angle, ball spin, and carry distance (Glazier, 2011). Strange & Anderson (1996) suggested that players do not swing before examining all options especially in a shot to the flag. They indicated that if you are down in a match, you probably have to take a bigger risk. At stroke play you are wise to play more conservatively and minimize your chances of making a big number.

The regression revealed that a negative linear correlation between Scrambling and Par 4 Performance ($t = -2.466$, $p < .05$), and Par 4 Birdie % ($t = -3.097$, $p < .01$). Meanwhile, Scrambling also demonstrated a positive linear relationship with Birdie Conversion % ($t = 2.021$, $p < .05$). There were no significant correlation between Scrambling and player's performance in Scoring Average Final Round (SAFR), Par Breakers, Scoring Average, Par 5 Performance, Par 3 Performance, Scoring Average 3rd Round (SA3R), Eagles, Birdie Average, Par 5 Birdie Percentage (P5BP).

Scrambling is defined as the percent of time that a player misses the green in regulation, but still makes par or better. DeGaetano (2005) stated that it is not easy to think and hit at the same time. Other thoughts like worrying about missing the green or the mechanics of your swing only serve as impediments. The casual golfer may also fall into a negative thinking after making an errant shot or scoring poorly on the previous hole.

Finally, this finding was also supported by Overtoom (2000) who found that the dual challenges of competing in the world and rapid technological advancements have made

innovative training known as the high-performance necessary. He also suggested that there is a need to require knowledgeable people to capable solve problems, create ways to improve methods, and engage effectively with their perfect game. Hence, in the PGA Tour players will need transferable core skills necessary for career success at all levels of performance and for all levels of education.

VI.CONCLUSSIONS

A.Conclusions

Conclusions drawn from this study reflect the research questions and the data gathered on subject's golf skill and performance factors in PGA Tour. Inferences from statistical analyses were as follows:

1.PGA players with good driving distance demonstrated good performance in Par Breakers, Par 5 Performance, and Par 3 Performance.

2.Good driving distance players did not show great performance in Par 4 Birdie %. But they had good performance in Eagles.

3.Driving Accuracy can help players to increase Par 4 Birdie %.

4.Players with high GIRP performance demonstrated great score in Par Breaker, and Eagles. But, high GIRP players did not found performance in Birdie Conversion %.

5.Scrambling revealed to negative linear correlation with Par 4 Performance, and Par 4 Birdie %.

6.Scrambling indicated a positive linear relationship with Birdie Conversion %.

B.Recommendations

The following recommendations for practice emerged from the result of the data analyses and findings of the study:

1.Special emphasis should be placed on improving knowledge for realistic goal setting and improvement in major significant relationship between golf skill and tournament performance.

2.Golf coaches, in order to increase players' golf performance, should encourage their players to strengthen their driving distance, swing accuracy, ball controlling ability, muscle strength, physically fitness, and teach them how to solve problems.

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The Connection between Golf Skill and Tournament Performance

Chun-Huang Liang[1*],Cheng-Jen Shih[2], Ming-Jui Wang[3]

Abstract This study was designed to determine the correlation between golf swing and 2010 PGA Tour performance. Golf skills were defined as independent variables, which were assessed swing performance: Driving Distance, Driving Accuracy, Greens in Regulation Percentage (GIRP), and Scrambling. The dependent variables were recorded by Tour performance such as 1.Scoring Average Final Round (SAFR), 2. Par Breakers, 3. Par 4 Performance, 4. Birdie Conversion %, 5. Scoring Average, 6. Par 4 Birdie %, 7. Par 5 Performance, 8. Par 3 Performance, 9. Scoring Average 3rd Round (SA3R), 10. Eagles, 11. Birdie Average, 12. Par 5 Birdie Percentage (P5BP). The SPSS Regression was used to determine the correlation between the dependant and independent variables. The .05 level of significant will be used for all Regression. Results:(1)The Regression indicated that Driving Distance revealed significant positive linear relationship with Par Breakers ($t = 3.940$, $p < .01$), Par 5 Performance ($t = 2.589$, $p < .05$), and Par 3 Performance ($t = 3.627$, $p < .01$). (2)Driving Distance showed significant negative linear relationship with Par 4 Birdie % ($t = -3.169$, $p < .01$), and Eagles ($t = -2.291$, $p < .05$). (3) Driving Accuracy indicated significant positive linear correlation with Par 4 Birdie % ($t = 2.110$, $p < .05$). 4) GIRP demonstrated significant positive linear relationship with Par Breaker ($t = 7.006$, $p < .01$), and Eagles ($t = 2.964$, $p < .01$) 5) GIRP indicated negative linear connection with Birdie Conversion % ($t = -11.610$, $p < .01$). 6). Scrambling revealed negative linear correlation with Par 4 Performance ($t = -2.466$, $p < .05$), and Par 4 Birdie % ($t = -3.097$, $p < .01$). 7). Scrambling indicated a positive linear relationship with Birdie Conversion % ($t = 2.021$, $p < .05$).

Recommendations: Golf coaches, in order to increase players' golf performance, should encourage their players to strengthen their driving distance, driving accuracy, ball controlling ability, muscle strength, physically fitness, mental toughness, and teach them how to solve problems.

Keywords: Driving Distance, Greens in Regulation Percentage, Scrambling.

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