

# The Health Status of Retired American Football Players

## Super Bowl III Revisited

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**Background:** Despite a perception that retired professional football players have poor health, there are little supporting data.

**Hypothesis:** Retired football players have poor health compared with age-matched population norms.

**Study Design:** Cross-sectional study; Level of evidence, 4.

**Methods:** Thirty-six of 41 members of the 1969 Super Bowl winning team were contacted 35 years after that event (3 were deceased, and no contact information was available for 2). Players completed an SF-36 health survey and a medical history and football-specific questionnaire. Each player's football-related injury history before 1969 was documented from medical records. It was estimated that there was 80% power to detect a 10% difference in physical and mental health scores between the retired football players (age,  $62 \pm 3$  y) and population norms ( $n = 741$ ) at an alpha level of 0.05.

**Results:** SF-36 scores for physical and mental health were not different from age-matched norms (physical health  $P = .69$ ; mental health  $P = .49$ ). The most prevalent medical conditions were arthritis (24 of 36 players), hypertension (13 of 36 players), and chronic low back pain (13 of 36 players). SF-36 physical health scores were 21% lower in players with arthritis ( $P < .01$ ) and back pain ( $P < .05$ ) compared with the other players. Physical health scores were 19% above normal for players without arthritis ( $P < .01$ ) and not different from normal for players with arthritis (6% lower;  $P = .6$ ). Four of 8 players who had major ligamentous injuries to the knee before 1969 had total knee arthroplasty in the intervening years, compared with 3 of the remaining 28 players ( $P < .05$ ). The men played professional football for  $8.3 \pm 3.8$  years, and 33 players (94%) reported having had "very fulfilling" ( $n = 24$ ) or "somewhat fulfilling" ( $n = 9$ ) careers.

**Conclusion:** These professional football players had long and fulfilling careers with no apparent long-term detrimental effects on physical or mental health scores despite a high prevalence of arthritis.

**Keywords:** SF-36; arthritis; National Football League; arthroplasty

The study of the longevity and health of former athletes who participated in sports with a high incidence of injury has been sparse. Football players in the National Football League (NFL) are exposed to a high injury risk. Based on data from 1 team followed by the same medical staff for 26 consecutive years, approximately every 3 games, 1 player

will sustain a major injury resulting in at least 8 weeks of missed playing time.<sup>15</sup> Considering this high injury rate, surprisingly little is known about the long-term health of retired American football players. Unpublished data,<sup>3</sup> expert opinion,<sup>2</sup> and various media reports<sup>4</sup> indicate that retired players have significant neurologic, orthopaedic, cardiac, and other medical problems in later life. Recently published data have identified neurologic problems in retired football players related to repeated mild traumatic brain injury.<sup>9,16</sup> Less is known regarding the prevalence or severity of orthopaedic, cardiac, or other medical problems in retired football players. A high prevalence of osteoarthritis has been reported in retired professional soccer players with an associated detrimental effect on quality of life.<sup>8,17</sup> Unpublished data<sup>3</sup> indicate a similar high

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prevalence of osteoarthritis in retired American football players, but the impact on quality of life is not known.

It is clear that there is a lack of published data on the health of retired American football players. Therefore, the purpose of this study was to examine the current health status of the members of 1 professional football team. The players were from the 1969 winning Super Bowl team. Given the importance of that game in NFL and US sports history, the players have maintained close connections with the team and, importantly, with the team physicians (J. A. N. and C. N.). These physicians examined all players when they first signed with the team in the 1960s, documented their injuries and medical conditions during their careers with this particular team, and since then have attempted to maintain contact to monitor changing health status and provide medical care and advice where necessary. This has afforded a unique opportunity to study the long-term health status of a select group of former professional football players with direct reference to their health and injury status at a specific point in their football career.

## METHODS

Forty players were on the roster for the Super Bowl in 1969; 1 player was inactive due to injury, providing a sample of 41 players. Of these 41 players, 3 were deceased at the time of data collection for this study (35 years after the Super Bowl). Thirty-six of the remaining 38 players were successfully contacted and consented to participate in the study. The study was approved by institutional review board. Players completed 2 questionnaires: an SF-36 health survey and a health and football-specific questionnaire designed specifically for this study.

### SF-36 Health Survey

The SF-36 health survey is a widely accepted questionnaire that has been used in more than 4 000 Medline-referenced publications.<sup>18</sup> The questionnaire comprises 36 separate questions relating to physical and mental health. The standard SF-36v2 form was used in this study. Completed questionnaires were transformed according to the publisher's guidelines.<sup>18</sup> The derived physical and mental health scores were compared with those of US population-based age-matched norms from 741 men.<sup>18</sup> This sample of 741 men was taken from 2 reported samples of 399 for men 55 to 64 years old (physical health score,  $48.16 \pm 10.23$ ; mental health score,  $52.53 \pm 9.67$ ) and 342 men 65 to 74 years old (physical health score,  $45.13 \pm 10.16$ ; mental health score,  $53.66 \pm 9.03$ ). The average age of the retired football players was  $62 \pm 3$  years, with a range of 58 to 75 years; 9 players were older than 64 years.

### Health and Football-Specific Questionnaire

A questionnaire was developed to provide a brief account of the players' current and previous medical problems and to provide specific details on their football career. Football-related information included length of career, positions

played, reason for retirement, and subjective assessment of career. Medical information consisted of a standard medical history. The questions on medical conditions asked whether a doctor had diagnosed any of a list of specific medical conditions.

### Health and Injury Status in 1969

The health and injury status of the Super Bowl players at the time was recorded by the team orthopaedist (J. A. N.) and internist (C. N.). This information was used as a frame of reference for players' health status 36 years later. Because of the strict medical criteria applied to player selection for this team in the 1960s, only 1 player was noted as having a significant medical problem (hypertension) on preseason physical examination in 1968. Twenty of 36 players had significant orthopaedic injuries before 1969, and 16 players had no significant injury history in 1969. A significant injury was defined as 1 requiring surgery or requiring prolonged nonsurgical treatment. Twelve players had previous knee injuries: 1 knee dislocation, 7 anterior cruciate ligament (ACL) tears, and 4 meniscal tears. Of the 7 players with ACL tears, 2 had associated combined medial collateral ligament (MCL) and medial meniscal tears, 3 had an associated medial meniscal tear (1 with osteoarthritis), 1 had an associated chondral injury, and 1 player had an isolated ACL tear. Of the 4 players with meniscal tears and intact cruciate ligaments, 3 had medial tears and 1 lateral; 1 meniscal tear was combined with an MCL tear, and osteoarthritic changes were evident in 2 knees with meniscal tears. All 12 players with previous knee injuries had a surgical intervention. A meniscectomy was performed on all meniscal tears. Five of the 7 ACL tears and the knee dislocation were treated with an extra-articular reconstruction.<sup>14</sup>

Four players had previous ankle injuries (3 functional ankle instability, 1 ankle fracture). Four players had previous back injuries (1 spondylolysis, 2 disk disease, 1 chronic mechanical low back pain). Two players had previous shoulder injuries (AC joint separation and glenohumeral joint dislocation); both of these players also had previous knee injuries. The ankle fracture was treated with an open reduction and internal fixation. The glenohumeral dislocation was treated with a Magnusson-Stack procedure.

### Statistics

SF-36 physical and mental health scores were compared between retired football players and age-matched controls using independent *t* tests. It was estimated that there was 80% power to detect a 10% difference in physical and mental health scores between the retired football players and age-matched population norms with an alpha level of 0.05. This estimate assumed that the SF-36 scores for the football players would have similar variance to the normative scores.

Independent *t* tests and 1-way ANOVA were used to compare SF-36 scores between subgroups of players based on selected criteria, for example, players with arthritis versus those without arthritis. Mean  $\pm$  SD is reported in text and

figures. The  $P$  values for all pairwise comparisons were adjusted for the number of comparisons (Bonferroni correction). For example, for the comparison of physical health scores between players with arthritis, those without arthritis, and normal values,  $P$  values have been multiplied by a factor of 3 (no arthritis vs arthritis, no arthritis vs normal, arthritis vs normal). Chi-square analyses were used to compare categorical variables between groups, for example, the prevalence of total knee arthroplasty in players who had and had not sustained major ligamentous knee injuries before 1969.

## RESULTS

### Details of Football Career

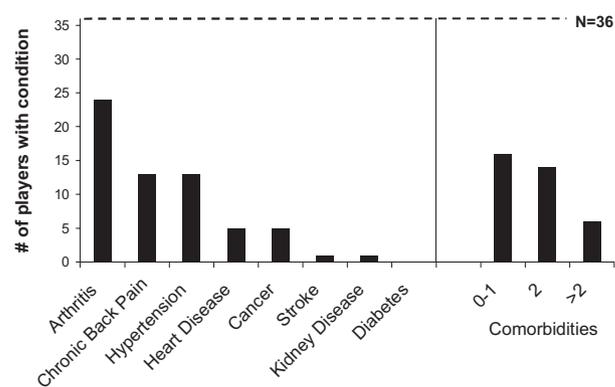
The average age of the players at the time of the Super Bowl was  $27 \pm 3$  years (range, 22-38 y). The average age of the players at the time of data collection for this study was  $62 \pm 3$  years (58-75 y). Therefore the average follow-up was 35 years from the Super Bowl (range, 35-36 y). The average length of the players' NFL careers was  $8.3 \pm 3.8$  years, with  $6.9 \pm 3.9$  years spent with this team. The data collection was  $32 \pm 3$  years after the end of the players' careers (range, 24-36 y). Twenty-three players retired voluntarily, 8 were cut and not picked up by another team, and 5 were forced to retire because of injury. Twenty-five players rated their careers as very fulfilling, 9 rated their careers as somewhat fulfilling, 1 player rated his career as unfulfilling, and 1 player rated his career as very unfulfilling. When players were asked, "In retrospect, if you had known what you know now, would you still have chosen to play professional football?" 34 replied they would still play, and 2 said they would not.

### Current Health Status

The most prevalent reported medical problem was arthritis (24 players, Figure 1) of which the knee was the predominant site (17 players). Thirteen players reported having hypertension and 13 had chronic back pain. Of the players reporting arthritis, 7 had chronic low back pain, 4 had hypertension, 4 had chronic low back pain and hypertension. Other medical problems were limited to 5 or fewer players, with none reporting having diabetes. Five players reported having no medical problems, and 20 players reported having more than 1 concurrent medical problem. Seven players had total knee arthroplasties (TKA), of which 5 were bilateral; 1 player had a total hip arthroplasty; and 1 player had a total shoulder arthroplasty (this player also had bilateral knee arthroplasty). One player reported that he was scheduled for a TKA at the time of data collection.

### SF-36 Physical and Mental Health Scores

SF-36 scores for physical and mental health for the retired football players were not different from age-matched norms (physical health,  $P = .69$ ; mental health,  $P = .49$ ;



**Figure 1.** The prevalence of medical problems in the retired players ( $n = 36$ ).

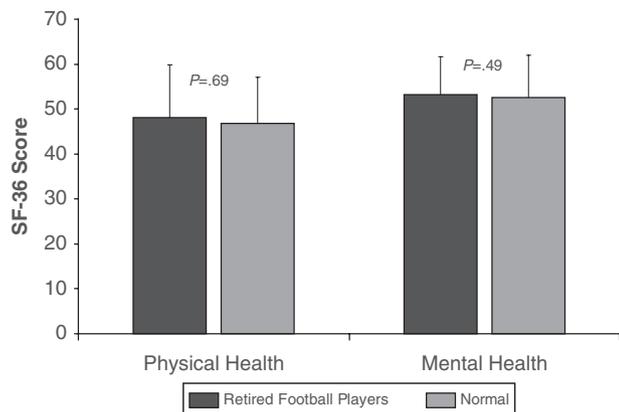
Figure 2). SF-36 physical health scores were 21% lower in players who reported having arthritis ( $P < .01$ ) and back pain ( $P < .05$ ) compared with the other players (Figure 3). Physical health scores were 19% above normal for players without arthritis ( $P < .01$ ) and not different from normal for players with arthritis (6% lower,  $P < .6$ ). Physical health scores were 11% above normal for players without back pain ( $P < .05$ ) and tended to be below normal for players who reported having back pain (12% lower,  $P = .12$ ). The combination of arthritis and back pain appeared to have a compounding effect on physical health scores. Eleven players reported having both arthritis (in a joint or joints other than the spine) and back pain, 13 players reported arthritis without back pain, 2 players reported back pain but no arthritis, and 10 players reported neither arthritis nor back pain. Physical health scores for players who reported having both arthritis and back pain ( $38.8 \pm 11.9$ ) were 17% below normal ( $P < .01$ ). Physical health scores for players who reported having neither arthritis nor back pain ( $56.4 \pm 4.0$ ) were 20% above normal ( $P < .01$ ).

Physical health scores were significantly higher for players without arthritis ( $55.9 \pm 4.6$ ,  $n = 12$ ) compared with players with arthritis who had not had total joint arthroplasty ( $42.6 \pm 11.7$ ,  $n = 16$ ,  $P < .01$ ) but not different from scores for players who had total joint arthroplasty ( $47.4 \pm 13.5$ ,  $n = 8$ ,  $P = .19$ ). However, the sample ( $n = 8$ ) was insufficient for a conclusive assessment on the effect of total joint arthroplasty on physical health scores.

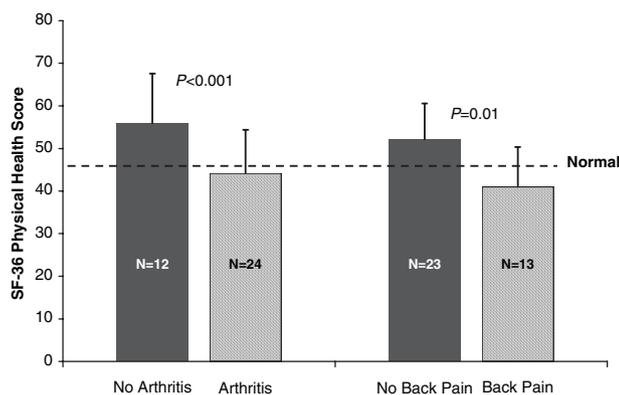
Mental health scores were unaffected by the presence or absence of any of the reported medical problems ( $P = .13-.95$ ). Mental health scores were  $53.1 \pm 8.9$  versus  $53.3 \pm 6.4$  for players with and without arthritis ( $P = .95$ ) and  $51.7 \pm 8.7$  versus  $54.0 \pm 7.8$  for players with and without chronic low back pain ( $P = .42$ ).

### Effect of 1969 Injury Status on Current Health Status

Physical and mental health scores were not different between the 16 players with no significant injury history in 1969 (physical health score,  $45.5 \pm 13.6$ ; mental health score,  $53.4 \pm 7.8$ ) compared with the 20 players who had



**Figure 2.** SF-36 physical and mental health scores for the retired football players versus US population age-matched norms.



**Figure 3.** SF-36 physical health scores for players with arthritis and back pain (shaded columns) compared with players without arthritis and back pain (black columns) and US age-matched population norms (dashed line). Players with arthritis and back pain had lower scores compared with the other players (*P* values shown). Physical health scores were higher than normal for players without arthritis (*P* < .01) and not different from normal for players with arthritis.

significant previous injuries (physical health score,  $50.1 \pm 9.7$ , *P* = .24; mental health score,  $53.1 \pm 8.4$ , *P* = .92).

Of interest were the health outcomes of the 12 players who had knee injuries before 1969, and specifically the 8 players who had major ligamentous injury to the knee (Table 1). Five of the 12 players with knee injuries before 1969 had subsequent TKA, compared with 2 of the remaining 24 players (*P* < .05). Eight of these 12 players had major ligamentous injuries to the knee before 1969. Four of the 8 went on to have a TKA, compared with 1 of 4 players with prior meniscal or chondral injury without cruciate ligament damage, and 2 of 24 players with no prior knee injuries (Chi-square linear association *P* < .05).

The mean body mass index (BMI) for the players in 1969 was  $28.7 \pm 3.0$ , with 36% of players classified as obese (BMI  $\geq 30$ ). Body mass index in 1969 was not correlated

**TABLE 1**  
Treatment and Long-Term Health Outcomes for Players Who Had Sustained Major Ligamentous Injury to the Knee Before the 1969 Super Bowl<sup>a</sup>

Injury	Treatment	Outcome	SF-36 Scores (Relative to Norms)	
			Physical Health (%)	Mental Health (%)
Knee dislocation	EA recon	No surgery No arthritis	+25	+16
ACL + MCL + MMT	EA recon	No surgery No arthritis	+16	-16
ACL + MCL + MMT	EA recon	TKA	-13	-37
ACL + MMT + OA	EA recon	TKA	-3	+18
ACL + MMT	MM	No surgery Arthritis	+21	+11
ACL + MMT	EA recon	TKA	+14	-14
ACL	EA recon	TKA	-21	+17
		pending		
ACL + OA	MM	TKA	-15	-10

<sup>a</sup>EA recon, extra-articular reconstruction; ACL, anterior cruciate ligament; MCL, medial collateral ligament tear; MMT, medial meniscal tear; TKA, total knee arthroplasty; OA, osteoarthritis or chondral injury; MM, medial meniscectomy.

with current physical health ( $r = -0.28$ , *P* = .1) or mental health ( $r = 0.18$ , *P* = .3). Body mass index in 1969 was not different between players currently with or without arthritis (*P* = .25) or chronic low back pain (*P* = .84).

### DISCUSSION

It was hypothesized that both physical and mental health would be impaired in this group of former football players compared with age-matched controls. Prior studies have associated poor health in retired professional soccer players with the prevalence of arthritis, which in turn was attributed to injuries sustained during their playing career.<sup>8,17</sup> Considering the injurious nature of professional American football,<sup>15</sup> a similar detrimental impact on long-term physical health status was expected. However, despite the high prevalence of significant orthopaedic injuries during their playing careers (20 of 36 players previously injured, 12 requiring surgery), and the subsequent high prevalence of arthritis (24 of 36 players reported having arthritis in 1 or more joints), the mean health score of this group of former football players was comparable with that of age-matched US population norms.

The SF-36 health assessment questionnaire was the measurement instrument used for assessing health status. This instrument was sufficiently sensitive to detect clear differences in current physical health between players with and without arthritis or back pain (Figure 2). Therefore, the lack of difference in health status between these players and age-matched population norms is likely

not due to inadequate sensitivity of the measurement tool. Of note, the physical health status of the players with arthritis was not different from population norms, while the health status of players without arthritis was better than age-matched norms. The prevalence of arthritis was 67% in this sample of former professional football players who had an average age of 62 years. The prevalence of arthritis was reported to be 40.72% for men in the US aged 65+ years old.<sup>11</sup> This high prevalence of arthritis is likely a function of the trauma sustained during the players' careers and to some of the treatments they were given. For example, complete meniscectomy and extra-articular reconstruction for ACL deficiency were performed on several players, but these procedures have long since fallen out of favor. The fact that no physical examinations and radiographs were made on the players in this study is a limitation with regard to the accurate prevalence of arthritis. However, the high prevalence of TKA in this sample of retired football players supports the conclusion that the prevalence of arthritis was higher than normal and that the knee was primarily affected. Five of the 36 players (14%) had TKA (5 bilateral). By contrast, the prevalence of TKA in the general population is less than 1% for men more than 60 years old.<sup>7,12</sup>

With respect to mental health, a prior study has linked impaired cognitive function to the long-term effects of repeated mild traumatic brain injuries sustained during a football career.<sup>9</sup> Additionally, a case report of chronic traumatic encephalopathy in a retired professional American football player was also attributed to repeated brain trauma during his playing career.<sup>16</sup> In the present study, statistics on the prevalence of mild traumatic brain injury were not collected. The prevalence and severity of mild traumatic brain injury was not routinely recorded at the time these players played professional football, and it was believed that players' recall of the number of such events would not be sufficiently reliable to be added to the data collection for this study. While it is possible that this group of players may have had similar cognitive impairments as those observed by Guskiewicz et al,<sup>9</sup> there was no apparent long-term impact on mental health status as assessed by the SF-36 (Figure 1). Furthermore, the players' mental health status was not affected by the prevalence of any of the reported medical conditions.

Several factors may explain the finding that the health status of these former football players was comparable with that of age-matched population norms despite a high prevalence of significant medical problems known to effect quality of life (arthritis and chronic back pain reported by 26 of 36 players). (1) Former professional football players may be better adapted to dealing with the limitations imposed by physical impairments due to injury. Considering that all but 2 of the players reported that they had fulfilling careers and would still have chosen to play professional football knowing what they know now, it is clear that these players do not have a negative perception of the health impact of their football careers. (2) The consistent medical care available to the players during their career with this team and subsequent availability to the same

medical care for many players in retirement may have minimized the potential effect of football-related injuries on long-term health. In the 1960s, sports medicine was in its infancy, and most professional teams did not have team physicians. This team had the same orthopaedist and internist on staff from 1960. (3) The players on this team had all undergone rigorous medical and orthopaedic screening before being drafted or signed by the team. Additionally, players were rescreened at the beginning of each season. Potential draft picks presenting with significant medical conditions such as hypertension or cardiac conditions were failed on physical examination and not selected. All players were classified into 1 of 4 groups based on their orthopaedic injury history and physical examination. Players in the lowest group were not selected; the other players' orthopaedic classification was used in conjunction with other football-related factors to come to a decision on selection. These players may represent a select group in terms of their health status at the time they joined the team. (4) The prevalence of serious medical conditions may not have been sufficiently higher in this sample of former football players compared with the general population in the same age range to significantly affect SF-36 scores.

One notable difference between the NFL players in 1969 and today's players is the prevalence of obesity. Recent research<sup>10</sup> has highlighted the high prevalence of obesity in NFL players at present (56%) compared with age-matched population norms (23%). The prevalence of obesity was 36% for the 1969 New York Jets (obesity defined as a BMI >30). Based on statistics from the Centers for Disease Control, the prevalence of obesity in male Americans aged 20 to 34 was 9.2% between 1960 and 1962 and 9.7% between 1970 and 1974.<sup>5</sup> The players were not asked to report their height and weight for the current study as it was thought that self-report of this data would not be sufficiently reliable for computation of current BMI statistics. The association between a high BMI and various medical problems is well established. With regard to this, it is worth noting that none of the players reported having diabetes. The Centers for Disease Control report a prevalence of diagnosed diabetes of 9.6% and 14.9% for white and black men, respectively, aged 45 to 64 years, and 20.4% and 29.1%, respectively, for those aged 65 to 74.<sup>6</sup> The absence of reported diabetes in this sample of 36 former professional football players with a mean age of  $62 \pm 3$  years contrasts significantly with the expected prevalence. Body mass index in these players in 1969 was not related to any of the current medical conditions that were reported.

It is difficult to make conclusions on the life expectancy of retired football players based on this small sample of former players. However, based on statistics from the Centers for Disease Control, expected survivorship for 62-year-olds is 83%.<sup>1</sup> Applying this to the current sample, 6 to 7 deaths would have been expected. The fact that only 3 deaths had occurred in this sample is in agreement with the previously unpublished findings from the National Institute for Occupational Safety and Health, where a lower than expected death rate was reported for retired football players. The death rate for retired players who had

played in the NFL for at least 5 years was 46% lower than for the general US population.<sup>13</sup> Given the opposing perceptions in the media in this regard, future study with a large sample size is clearly warranted.

A unique aspect of this study was having access to the players' specific injury history and treatments during their playing careers before 1969. A history of significant orthopaedic injury before 1969 clearly did not affect the players' health status 35 years later. This may be a function of successful management of these injuries. However, it was evident that ligamentous injury to the knee during their playing careers increased the likelihood of subsequent TKA. Four of the 8 players with prior ACL injuries had subsequent TKA compared with 2 of 24 players with no prior knee injuries. Furthermore, 1 player who had a prior ACL injury was scheduled for a TKA at the time of data collection. Of the 4 players with previous ACL injuries who subsequently had TKAs, 2 had bilateral TKAs and 2 had a TKA on the ACL-involved side. Both of the previously uninjured players who had subsequent TKA had bilateral TKA, 1 of whom also had a total shoulder arthroplasty. The bilateral knee involvement and shoulder involvement in these players suggests other predisposing factors.

The primary limitation of this study is that the findings may not be generalizable to all retired professional football players. This was a small, select sample of football players who, having participated in one of the most significant games in NFL history, may have had a more positive experience in the sport than most players. This unique experience may have affected how they now perceive their quality of life and the effect of football-related injuries. Additionally, the team's medical staff applied strict criteria for grading preparticipation medical and orthopaedic examinations for drafted and traded players. This meant that the players who made it onto the team were probably healthier than the general population of professional football players at that time. Most of the players had spent their entire careers to that point with this team. As a group, the players spent 83% of their careers with this team. Considering that they were in a fledgling league with an uncertain future and widespread player movement between teams, the personnel stability on this team may in part be related to the strict selection criteria. Based on these limitations with regard to the generalizability of these data, a study examining the current health status of a much larger and more representative sample of players from this era is clearly needed.

In conclusion, these former professional football players had long and fulfilling careers with no apparent long-term

detrimental effects on physical or mental health scores despite a high prevalence of arthritis.

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