OVER the past 2 decades, growing evidence suggests that kidney transplantation significantly improves the quality of life in patients with chronic renal failure [1–4]. Even if deterioration of the psychophysical condition is a consequence of end-stage renal disease and associated treatments, after renal transplantation patients have more opportunities to return to work and are more eager to take part in social life, and the way they spend their leisure time changes as well [5]. Moreover, after an immediate decrease in physical activity after transplantation, most kidney recipients become spontaneously more active with time [6]. The negative impact of sedentary lifestyle and the benefits of physical and sport activity are well documented in many
medical conditions, including chronic kidney disease [7–11]. Positive effects at a physical level, similarly to other populations, include reduced risk of coronary heart disease, hypertension, and colon cancer [12]. Moreover, several studies indicated that sport activity can improve mental health and reduce depression [13], contributing to personal enjoyment, personal growth, social integration, and social change [14,15].

Increased activity that accompanies successful renal transplantations is consistent with a better health-related quality of life (HRQoL) [6], and exercise training is considered to be a promising instrument for improving health outcomes of transplant recipients [16–19]. However, the effects of spontaneous sport activity among kidney transplant patients on their HRQoL were largely understudied until the middle 1990s. For example, the study by Painter et al assessed the levels of health-related fitness and quality of life in a heterogeneous sample of 128 organ transplant recipients (76 kidney) taking part in the 1996 US Transplant Games [20]. Results showed that active participants demonstrated significantly higher levels of HRQoL compared with inactive subjects and that scores on the SF-36 scales were similar to the general population normative values [20].

The aim of the present study was to investigate the effects of sport activity of kidney transplant recipients on their quality of life. A group of active kidney transplanted patients (AKTPs) was compared with a group of sedentary kidney transplanted patients (SKTPs) and with a group of active healthy control subjects (AHCs) on different dimensions of HRQoL. We also tested whether HRQoL in AKTPs differs depending on quantity of sport activity and time since transplantation.

**METHODS**

**Selection and Description of Participants**

The data were collected from 2008 to 2013, as part of the project “Trapianto...e adesso sport” of the National Italian Transplant Center (Ministry of Health). AKTPs were recruited during national and international sport competitions which were accessible to transplant recipients [1]. A control group of SKTPs were recruited in Italian transplant centers involved into the project, and a group of AHCs were recruited in amateur sport competitions [2].

AKTPs (n = 118) were 83% male and 17% female; the mean age was 46.4 ± 12.1 years. The mean time since transplantation was 11.8 ± 7.6 years (range, 0.5–15.0 y). They practiced swimming (17%), road cycling (21%), alpine and cross-country skiing (22%), track and field (23%), and other sports (17%) with weekly training sessions of 3 ± 1 hours for a total of 5 ± 4 h/wk.

SKTPs (n = 79) were 53% male and 47% female; the mean age was 46.0 ± 10.6 years, and the mean time since transplantation was 3.3 ± 2.8 years (range, 0.5–14.0 y). All of the patients included in this group had a sedentary lifestyle (no training sessions during the week).

AHCs (n = 120) were 71% male and 29% female; the mean age was 43.6 ± 13.1 years. They practiced road cycling (72%), swimming (21%), track and field (2%), and other sports (5%) with weekly training sessions of 3 ± 2 hours for a total of 8 ± 5 h/wk.

**HRQoL Measurements**

HRQoL was measured with the 36-Item Short-Form Health Survey (SF-36), including 8 components of health-related quality of life: Physical Functioning, Role Limitations Due to Physical Problems, Bodily Pain, General Health Perceptions, Vitality, Social Functioning, Role Limitations Due to Emotional Problems, and Mental Health [21,22]. Item scores were summed for each scale and transformed on a scale of 0 to 100, so that higher scores represent better health.

The study was conducted in accordance with recognized ethical standards [23]. Participants were informed about the nature of the research, anonymity, and the right they had to withdraw from the study at any time. Informed consent was given by each of the respondents. The instrument was administered by a trained researcher, a member of the project team.

**Statistical Analyses**

Quantity of sport activity (among AKTPs and AHCs) was measured with the number of hours per week spent in training and sport in the previous month. For the purposes of analysis, the impact of this variable was tested by distinguishing participants into 2 numerically homogeneous groups, labelled arbitrarily as low (≤4 h/wk) and moderate (>4 h/wk) sport activity. Sex and age (≤45 y; >45 y) were also included.

Statistical analyses were performed with the use of SPSS. Differences between groups were tested with the use of 1-way analysis of variance (ANOVA).

In the SKTP group, the impact of quantity of sport activity and sociodemographic characteristics on HRQoL was tested with the use of factorial ANOVA.

A 2-way ANOVA was conducted to test the differences in HRQoL among transplant patients (AKTPs and SKTPs) depending on the time since transplantation (<3 y; 3–9 y; >9 y). 

P values were considered to be significant at P < .05 and P < .01. Where statistically significant differences were observed, post hoc Bonferroni test was performed.

**RESULTS**

**HRQoL**

Table 1 presents descriptive results of HRQoL in the 3 groups (AKTPs, SKTPs, and AHCs). AKTPs did not differ from AHCs in the Physical Functioning, Role Physical, General Health Perception, Role Emotional, and Vitality scales, whereas on the same scales SKTPs reported significantly lower scores. AKTPs obtained higher scores than SKTPs and even AHCs on the Mental Health and Social Functioning scales. No significant differences were found between AKTPs and SKTPs in the Bodily Pain scale.

**Time Since Transplantation**

Results did not show any significant differences according to time since transplantation.

**HRQoL Among AKTPs: Effect of Quantity of Sport Activity and Type of Sport**

Table 2 presents the descriptive statistics of HRQoL scales among AKTPs. The effect of quantity of sport activity was significant on the General Health Perception (P < .01; η² =...
and do not differ from healthy control subjects in how they perceive limitations to their role due to their condition (eg, everyday activities requiring some physical effort) (eg, dialysis). In accord with this, the psychologic well-being literature suggests the potential benefits of coping strategies based on cognitive restructuring [24], including the use of different types of standards by individuals when assessing their current life condition (eg, social comparisons with less fortunate others), as well as the central role of social support resources and strategies.

Finally, time since transplantation did not differentially affect levels of HROQL. This result suggests that the improvement in HROQL after kidney transplantation is not a linear process [25]. With time, several factors may evaluate their overall health status and degree of vitality and psychologic health.

Our results support the usefulness of specific programs of regular and spontaneous physical activity as part of the routine post-transplantation care [17–19]. These kinds of interventions should be conceived with the idea of overcoming the initial little motivation of transplant recipients for exercise and sport, communicating correct information about the potential physical and psychologic benefits in terms of HROQL.

The present study confirms earlier results about the post-transplantation improvement of HROQL for kidney recipients not involved in sports [1,5]. Owstrosky et al [5] suggested that after kidney transplantation, patients possess a remarkable ability to adapt to their disease so that they appreciate any improvement in their HROQL, more so than the general population. Along the same lines, Painter et al [24] referred to a process of “resetting of expectations” of transplant patients compared with alternatives to transplantation (eg, dialysis). In accord with this, the psychologic well-being literature supports the potential benefits of coping strategies based on cognitive restructuring [24], including the use of different types of standards by individuals when assessing their current life condition (eg, social comparisons with less fortunate others), as well as the central role of social support resources and strategies.
influence HRQoL, including intervening worries about the new clinical condition.

More research is needed to clarify how psychologic and psychosocial processes interact with biologic factors in explaining the experience of these patients and the role of sports in sustaining recovery processes as well as maintenance of a healthy condition after transplantation. The adoption of longitudinal research designs, considering also drug therapy, would allow us to more clearly describe the impact of sport activity on HRQoL and to describe the involved psychosocial processes. Future research adopting larger and more differentiated samples is needed to overcome these limits.

CONCLUSION
This study indicated that regular sport activity significantly improves different dimensions of HRQoL among kidney transplant recipients. The benefits of sport activity go beyond its impact on physical health to involve psychologic and social components of quality of life. Spontaneous and low to moderate sport activity may play an important role after kidney transplantation that is largely underestimated in the literature.

ACKNOWLEDGMENTS
The authors thank the clinic staff and respondents who contributed to this study.

REFERENCES