Short-term Healthy Lifestyle Intervention and Long-term Behavior Change After Kidney Transplantation: Findings From the CAVIAR Study

Kulli Kuningas, MSc, Joanne Driscoll, BSc, Reena Mair, BSc, Edward Day, MD, Adnan Sharif, MD

PII: S0272-6386(22)00932-5
DOI: https://doi.org/10.1053/j.ajkd.2022.08.020
Reference: YAJKD 57791

To appear in: American Journal of Kidney Diseases

Received Date: 18 January 2022
Accepted Date: 11 August 2022


This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2022 Published by Elsevier Inc. on behalf of the National Kidney Foundation, Inc.
Short-term Healthy Lifestyle Intervention and Long-term Behavior Change After Kidney Transplantation: Findings From the CAVIAR Study

Kulli Kuningas MSc¹, Joanne Driscoll BSc², Reena Mair BSc², Edward Day MD³, Adnan Sharif MD¹,⁴

Departments and Institutions.

¹Department of Nephrology and Transplantation, University Hospitals Birmingham, UK
²Department of Nutrition and Dietetics, University Hospitals Birmingham, UK
³School of Psychology, University of Birmingham, UK
⁴Institute of Immunology and Immunotherapy, University of Birmingham, UK

Corresponding author contact information.

Dr. Adnan Sharif

Department of Nephrology and Transplantation

University Hospitals Birmingham, Queen Elizabeth Hospital, Edgbaston, Birmingham, B15 2GW, United Kingdom

Email: adnan.sharif@uhb.nhs.uk. Orcid ID: 0000-0002-7586-9136, Twitter:

@AdnanSharif1979
To the Editor:

Our previous work explored the benefit of active versus passive lifestyle modification in non-diabetic kidney transplant recipients in the CAVIAR (Comparing glycaemic benefits of Active Versus passive lifestyle Intervention in kidney Allograft Recipients) randomized controlled trial.\(^1\) It introduced the concept of incorporating evidence-based behavior change therapy (BCT) into post-transplant care. While failing to show any benefit in the primary outcome of glycemic pathophysiology, it demonstrated improvements in secondary outcomes including weight, fat mass and a trend towards less PTDM (7.6% versus 15.6%) for active versus passive intervention arms respectively after a 6-month personalized intervention.

However, evidence for long-term adherence to health behavior change is poor in the general population.\(^2\) Typically, encouraging early response after any targeted behavior change intervention is followed by diminished adherence in the long-term. Low self-reported health,\(^3\) depression\(^4\) and lack of motivation\(^5\) are linked to poor adherence to lifestyle changes in the general population, but evidence for this post-transplant is lacking.

One of the a priori CAVIAR study objectives was to explore if behaviour change is sustained after study completion. Details of the CAVIAR study and 6-month outcomes have been reported.\(^1\) For this analysis, change in 3-year outcomes from baseline were compared between randomized cohorts. Post-study outcomes were linked to psychological measures tested during the original CAVIAR trial to determine association. This included EQ-5D (questionnaire relating to health status and quality of life),\(^2\) the Beck Depression Inventory [BDI-II] (specific tool for depression),\(^3\) and the Situational Motivation Scale [SMS] (specific tool to assess motivation).\(^4\) Detailed methodology is reported in Item S1.
Figure S1 provides a CONSORT flow diagram for data analysis. As shown in Figure 1, active versus passive study participants experienced divergent weight during study participation but converge back to baseline weight after study completion. Figure S2 provides a scatterplot of weight change during versus post study period, stratified by randomization status for individual participants. Table 1 highlights similar cardio-metabolic and safety parameters between study participants at 3-years, including no PTDM difference (16.1% versus 13.6% for active versus passive intervention arms respectively, p=0.7).

No correlation was seen between weight change during or after study and different components of motivation, depression, or health status (data not shown). No association was observed between participant age, BMI, ethnicity, or sex with evolution of weight either during or after study completion (Figures S3 and S4).

Multiple linear regression analysis is reported in Table S1. With regards to weight change during study intervention, the overall regression model wasn’t significant but randomisation group significantly predicted weight change (coefficient estimate 2.14 [95% confidence interval 0.56 to 3.73], p=0.009). With regards to weight change after study completion, the overall regression model wasn’t significant but randomisation group significantly predicted weight change (coefficient estimate -2.88 [95% confidence interval -5.27 to -0.49], p=0.02). This significance was removed if weight change during study was added to the model (coefficient estimate -2.37, [95% CI -4.90 to 0.16], p=0.07).

We can hypothesize kidney transplant recipients have greater motivation to sustain any BCT, as they worry about developing post-transplant metabolic problems. However, our findings suggest even transplant patients will lapse from any adopted behavior change in the absence
of continued intervention. Paradoxically we observed metabolic improvements over time in the passive arm. This may relate to immunosuppression changes, confounding factors, or lifestyle changes initiated after trial completion due to study feedback provided to all study participants.

In a systematic review and thematic analysis of qualitative studies exploring motivations, challenges, and attitudes toward self-management among kidney transplant patients, Jamieson et al. summarized findings from 50 studies involving 1,238 recipients. They identified 5 important themes important for patient self-management after transplantation: 1) empowerment through autonomy, 2) prevailing fear of consequences, 3) burdensome treatment and responsibilities, 4) overmedicalizing life, and 5) social accountability and motivation.

Therefore, robust BCT adoption and implementation into sustained post-transplant care models needs further investigation. A range of behavior change theories exist, with the ABC of Behavior Change Theories summarizing 83 different theories comprising over 1,600 constructs. However, a number of problems concerning incorrect use of theory in the development of behavior change interventions are highlighted. A recent meta-analysis found less than a quarter of implementation studies explicitly used theories of behavior change. The wide range of theories of health behavior contain many overlapping constructs, and so choosing a relevant theory can be difficult for intervention designers. Translating theories to transplant patients will be more challenging, with their greater complexity and significant burden of care, and requires the necessary support and infrastructure.
This analysis explores the sustainability of a BCT after transplantation beyond the initial delivery. While further research is recommended for future direction, with collaboration between transplant professionals and social scientists, our findings suggest incorporating any BCT into post-transplant care must be a continual process rather than a one-off intervention due to risk of behavior relapse.

Article Information

Authors’ Contributions

Research idea and study design\textsuperscript{AS}, Study delivery\textsuperscript{KK,JD,RM,ED}, Data acquisition\textsuperscript{KK}, Data analysis\textsuperscript{KK,AS}, Supervision and mentorship\textsuperscript{ED,AS}. Each author contributed important intellectual content during manuscript drafting or revision and agrees to be personally accountable for the individual’s own contributions and to ensure that questions pertaining to the accuracy or integrity of any portion of the work, even one in which the author was not directly involved, are appropriately investigated and resolved, including with documentation in the literature if appropriate.

Support

This study was supported by grants from the European Foundation for the Study of Diabetes and the British Renal Society/Kidney Care UK. The funders had no role in study design; collection, analysis, and interpretation of data; writing the report; or the decision to submit the report for publication.

Financial Disclosure

The authors declare that they have no relevant financial interests.

Peer Review

Peer Review: Received January 18, 2022. Evaluated by 2 external peer reviewers, with direct
editorial input from a Statistics/Methods Editor, an Associate Editor, and the Editor-in-Chief.

Accepted in revised form August 11, 2022.

References

Table 1. Change in cardiometabolic parameters between baseline and 3-years comparing active versus passive lifestyle intervention groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Numbers</th>
<th>ACTIVE group² (N=66)</th>
<th>PASSIVE group² (N=64)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>+0.5</td>
<td>-0.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>+9.2</td>
<td>+12.7</td>
<td>0.4</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>+0.23</td>
<td>+0.60</td>
<td>0.9</td>
</tr>
<tr>
<td>Anti-hypertensive drugs</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>74.2%</td>
<td>79.7%</td>
<td>0.5</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>+0.44</td>
<td>+0.31</td>
<td>0.6</td>
</tr>
<tr>
<td>Lipid lowering drugs</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>58.1%</td>
<td>41.9%</td>
<td>0.4</td>
</tr>
<tr>
<td>PTDM</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>16.1%</td>
<td>13.6%</td>
<td>0.7</td>
</tr>
<tr>
<td>Creatinine (mmol/L)</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>+3.17</td>
<td>+1.24</td>
<td>0.8</td>
</tr>
<tr>
<td>Urine ACR² (mg/mol)</td>
<td>N=121 (active; 62, passive; 59)</td>
<td>+0.48</td>
<td>-5.83</td>
<td>0.7</td>
</tr>
<tr>
<td>MACE³ episodes</td>
<td>N=130 (active; 66, passive; 64)</td>
<td>0.0%</td>
<td>3.3%</td>
<td>0.1</td>
</tr>
<tr>
<td>Patient survival</td>
<td>N=130 (active; 66, passive; 64)</td>
<td>96.8%</td>
<td>98.3%</td>
<td>0.6</td>
</tr>
<tr>
<td>Graft survival</td>
<td>N=130 (active; 66, passive; 64)</td>
<td>100.0%</td>
<td>96.7%</td>
<td>0.1</td>
</tr>
</tbody>
</table>

¹Categorical variables are measured at year 3
²The sample size was 62 (active) and 59 (passive) for all variables other than the last three.
³Albumin-creatinine ratio
⁴Major adverse cardiovascular event
Figure legends

Figure 1. Evolution in weight during the CAVIAR study (Day 0 to 180) and after study completed (Day 180 to Year 3)