

Profiling potential medical students and exploring determinants of career choice

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Abstract

At this university, a Biomedical Common Year 1 occurs prior to admission to the medical programme. Students achieving a minimum GPA of 6.0 are eligible for consideration for an admissions interview. The aim of this research was to assess the psycho-educational factors that underpin students' intention to study medicine. The research question driving the research was, 'If students have an interest in becoming a future doctor in their premedical course, does this relate to their levels of motivation, competitiveness, perceived stress, health-related quality of life (HRQOL), and grade attainment?' A total of 339 students (response rate = 25%) who completed a biosciences assessment filled in a survey that asked them to disclose their grade and to respond to a series of questionnaires, namely the Motivated Strategies for Learning Questionnaire, World Health Organisation Quality Of Life questionnaire - New Zealand Version, Perceived Stress Scale, and Revised Competitiveness Index. The findings from the binary logistic regression indicated that several variables predicted students' career intentions: grade achievement, Perceived Stress, Physical HRQOL, and Environmental HRQOL. Perceived Stress and Physical HRQOL were found to be influential variables that interacted with other variables reducing variability in the model and increasing its predictability. Students with an intention to become a doctor tend to attain higher grades and have better environmental HRQOL scores. Nonetheless, variable interactions suggested that those students with high levels of physical HRQOL and low levels of perceived stress have higher levels of enjoyment regarding competition, self-efficacy, and intrinsic value.

Keywords: *Biomedical and Health Science Students, New Zealand, Career Intention, Motivation, Physical Wellbeing, Competitiveness, Motivation, Academic Achievement*

Practice Highlights

- The impact of students' intentions to enroll in either medicine or other health science courses were considered with respect to differences in grade achievement, levels of competitiveness, perceived stress, quality of life and motivational beliefs.
- The findings indicated that those students intending to study medicine: achieved higher grades, indicated higher levels of enjoyment with competition, specified greater environmental health-related quality of life, and suggested higher levels of motivation.
- Measures of perceived stress and physical health related quality of life interacted with levels of competitiveness and motivational beliefs indicating that students with higher physical health related quality of life and lower stress were more competitive and more highly motivated.
- The findings have implications for selection of students and in inculcating methods of learning that engender the culture of working with heterogeneity, openness and constructive problem solving.

I. INTRODUCTION

The focus of this study was to determine learning and psychosocial variables that are enhanced or diminished in reference to students intending to enrol in medicine versus other health-oriented professions. There have been some studies that have compared medical students with other health professional students in terms of learning strategies and academic achievement. For example, Salamonson, Everett, Koch, Wilson, and Davidson (2009) noted that medical students obtained higher scores than nursing students in peer learning, help seeking, critical thinking, grade point average, and management of time and study environment. However, we found no studies that compared students in their premedical year with respect to their intention to study in medicine versus other health-oriented programmes. In the present study, we sought to increase our awareness of students' behaviours and their needs in regard to those intending to study medicine versus those who chose other career paths. To explore this potential difference, we chose several operational variables that could define and inform the learning characteristics of aspiring medical students in contrast to those seeking to be in other health-oriented professions.

Our first area of investigation was to determine the impact of grade accomplishment. Grade accomplishment is an important requirement for students to enter into any medical programme (Al Alwan, Al Kushi, Tamim, Magzoub, & Elzubeir, 2013; McManus et al., 2005; Shulruf, Poole, Wang, Rudland, & Wilkinson, 2012; The University of Auckland, 2015b). At the University of Auckland, New Zealand, the requirements for entry into medicine via the Biomedical Common Year 1 programme are defined as: "Following the successful completion of the eight prescribed first year courses, applicants achieving a minimum GPA of 6.0 (B+ average, on a scale of 0.00 to 9.00, where D is 0.00 and A+ is 9.00) are eligible for consideration for an admissions interview" (The University of Auckland, 2015b). The rationale and empirical evidence with regard to academic attainment grades is clear; high achievement in pre-medical courses predicts later achievement in medical courses (Shulruf et al., 2012) and, in the U.K., pre-medical academic achievement scores (A levels) are good indicators of cognitive ability (McManus et al., 2005). Moreover, students, in achieving high A level scores, tend to exhibit "appropriate motivation, commitment, personality, and attitudes, traits that are also beneficial at medical school and for lifelong learning" (McManus et al., 2005, p. 556).

An additional consideration of the present study was whether levels of competitiveness could predict career intention. Students who are strategically motivated often recognize that to be successful is to be competitive (Hilliard, 1995) and this is especially true for students focusing on certain disciplines within medicine such as

surgery (Glynn & Kerin, 2010). Competitiveness is a systems and personality variable and is present when students consider their course of study or later medical specialities (Fincher, Lewis, & Rogers, 1992). Interestingly, and with respect to medical learning, there is evidence suggesting that competitiveness declines over time of study and in later years students tend to be more motivated by experiential learning and the need to be a competent doctor (Hilliard, 1995).

Furthermore, there is considerable evidence to suggest that wellbeing and health-related quality of life (HRQOL) are major issues to consider in the medical and health sciences disciplines and this may also impact their career intention (Chang, Eddins-Folensbee, & Coverdale, 2012; Dyrbye et al., 2006; Dyrbye, Thomas, & Shanafelt, 2006; Henning, Krägeloh, Hawken, Zhao, & Doherty, 2010; Paro et al., 2010; Tempiski et al., 2012). There are clear indicators as to why students studying medicine may have compromised experiences of HRQOL and some of these may include experiencing excessive competition, sleep deprivation, perceptions of poor teaching, excessive workload, and unmanageable educational schedules (Henning, Hawken, & Hill, 2009; Henning et al., 2010; Tempiski et al., 2012).

Lastly, we aimed to determine the impact of motivational beliefs. In our previous work we found that two motivational beliefs were able to discriminate between sub-groups within the medical student cohort, namely test anxiety and self-efficacy (Henning et al., 2011; Henning et al., 2013). Other studies have also found that factors - such as low task value, self-efficacy, enjoyment, boredom and anxiety - defining the concept of motivational beliefs were able to predict academic success in medical students (Artino, La Rochelle, & Durning, 2010; Artino Jr, Hemmer, & Durning, 2011). Non-academic motivations that include altruism and intellectual challenge have also been studied in reference to gender differences and choosing a career in medicine, although no significant difference were found between the two groups with regards these motivational factors (Todisco, Hayes, & Farnill, 1995).

The aim of the present paper was to explore the relationships between these operational variables and to discern whether students aiming to study medicine differed from students not targeting medicine in terms of their learning and psychosocial profile. The research question driving the research was, 'If students have a definite interest in becoming a future doctor in their premedical course, does this relate to their levels of motivation, competitiveness, perceived stress, HRQOL and grade attainment?'

II. METHODS

A. Participants

Invitations were sent via email to all students ($N=1369$) enrolled in the bioscience year 1 course of the *Biomedical Common Year or Overlapping Year 1* programme at this university (The University of Auckland, 2015a).

B. Procedure

Ethics approval for the study was obtained from the University of Auckland Human Participants Ethics Committee. Students were emailed directly, with two follow-up reminders, about the study and invited to participate in a Google survey. This survey included items pertaining to demographic information and the instruments cited below (Google.com, 2015). The study data collection was anonymous and conducted over a one month period.

C. Measures

Demographic and background details: Several measures pertinent to this paper were obtained: (1) age in years; (2) gender; (3) students were asked whether they would like to pursue a career in medicine (yes/no); and (4) the self-disclosed measures of academic attainment in their mid-year bioscience assessment which were converted to numerical values (0=fail,1=C-,2=C,3=C+,4=B-,5=B,6=B+,7=A-,8=A,9=A+).

Motivated Strategies for Learning Questionnaire: Three of the five sub-scales were used in this study, namely self-efficacy, intrinsic value, and test anxiety (Pintrich & De Groot, 1990).

World Health Organisation Quality Of Life questionnaire (New Zealand Version): This version has 31 items and was developed for measuring HRQOL amongst New Zealanders (Feng, Krägeloh, Billington, & Hsu, 2011; Krägeloh et al., 2013). As with the original WHOQOL-BREF (WHOQoL Group, 1998), which has 26-items, the new version is comprised of four domains: physical HRQOL, psychological HRQOL, social relationships, and environmental HRQOL.

Perceived Stress Scale: This scale is unidimensional with 10 items and measures the level of perceived stress in relation to respondents' life experiences in certain situations within the last month (Cole, 1999).

Revised Competitiveness Index: This instrument contains 14 items and measures enjoyment of competition and levels of contentiousness or avoidance and dislike of conflict situations (Houston, Harris, McIntire, & Francis, 2002).

All items in the above questionnaires required participants to respond to a 5-point Likert scale.*D. Data analysis*

First, statistics were presented that described the response rate (n/N), and the participants' demographic and background details. Second, the internal consistency measures for each domain within the measurements used were checked using Cronbach alpha coefficients. In the main analyses and to explore differences between those students who aim to be doctors versus those who do not, a binary logistic regression was conducted with four-blocks: demographic variables and bioscience grade at Block 1, competitiveness measures at Block 2, stress and quality-of-life measures at Block 3, and motivation measures at Block 4. Finally, as a post hoc process, the contribution of each independent variable was appraised. Descriptive statistics and t-test mean comparisons were computed for all dependent variables and correlations were conducted on targeted variables.

III. RESULTS

A. Response rate and participant data

A total of 339 (response rate = 25%) students in Biomedical Common Year 1 programme were eligible for this aspect of the research. The average age for all participants was 18.94 years ($SD=2.80$). More female ($n=253$, 75%) students responded to the survey than their male ($n=86$, 25%) peers. The student population statistics generated a higher mean age of students studying this course of study at 19.60 ($SD = 2.70$) and lower female proportional representation at 65%. Grade attainment was well spread in both the sample and population statistics, with marginally higher proportion of high achieving students responding in the study than those in the main population. These sampling differences, albeit small, may be a source of response bias.

In our sample, 54% ($n=183$) of participants indicated a preference for medicine. If this sample is representative of the Biomedical Common Year 1 programme population we could extrapolate that 739 out of 1369 students had an interest in study medicine.

B. Questionnaires – internal consistency measures

All measures used in this study were found to be internally consistent, with Cronbach alpha coefficient measures above the recommended cut-off of .70 (Field, 2005). The coefficient measures for Motivational Beliefs variables included intrinsic value ($\alpha = .83$), self-efficacy ($\alpha = .90$), and test anxiety ($\alpha = .84$). The Cronbach alpha scores for the domains of the WHOQOL-BREF, Perceived Stress Scale and Revised Competitiveness Index were physical HRQOL ($\alpha = .77$), psychological HRQOL ($\alpha = .85$), social relationships ($\alpha = .70$), and environmental HRQOL ($\alpha = .78$). And for the remaining measures: the PSS ($\alpha = .86$), enjoyment of competition ($\alpha = .91$) and contentiousness ($\alpha = .83$).

C. Binary Logistic modelling

First, potential problems with multicollinearity were checked and, overall, the statistics revealed no major concerns with the Variance Inflation Factor (VIF) values for all but one of the independent variables. In general, values were close to 1.00 and Tolerance values were found to be above .20 (Field, 2013). However, the VIF for psychological health-related quality of life was 3.05 and highly correlated with perceived stress ($r=-.70, p<.001$), hence we removed psychological health-related quality of

life from the main model.

As shown in Table 1, at Block 1, only grade predicted student career intention. At Block 2, enjoyment of competition predicted future career intention. At Block 3, perceived stress, physical HRQOL and environmental HRQOL measures significantly added to the prediction career intention. Lastly in Block 4, when the motivation measures were added to the model, no motivational scores predicted career intention.

Block	Variable	β	S.E.	Wald Chi-square	df	p	Exp(β)
1	Age	-.10	.29	.13	1	.72	.90
	Gender	-.01	.04	.03	1	.86	.99
	Bioscience grade	.44	.06	57.29	1	.00	1.56
2	Age	-.19	.30	.42	1	.52	.83
	Gender	.00	.04	.00	1	1.00	1.00
	Bioscience grade	.43	.06	53.37	1	.00	1.54
	Enjoyment of competition	.32	.15	4.88	1	.03	1.38
	Contentiousness	.04	.14	.10	1	.75	1.04
3	Age	.02	.04	.21	1	.65	1.02
	Gender	.08	.33	.06	1	.81	1.08
	Bioscience grade	.49	.07	57.62	1	.00	1.64
	Enjoyment of competition	.39	.16	5.59	1	.02	1.47
	Contentiousness	.02	.15	.02	1	.88	1.02
	Perceived Stress	.51	.24	4.28	1	.04	1.66
	Physical HRQOL	-1.05	.30	11.88	1	.00	.35
	Social Relationships	-.10	.20	.26	1	.61	.90
Environmental HRQOL	1.28	.29	19.33	1	.00	3.61	
4	Age	.00	.04	.00	1	.96	1
	Gender	.05	.35	.02	1	.89	1.05
	Bioscience grade	.43	.07	37.58	1	.00	1.54
	Enjoyment of competition	.32	.17	3.55	1	.06	1.37
	Contentiousness	-.02	.15	.01	1	.91	.98
	Perceived Stress	.61	.27	5.14	1	.02	1.84
	Physical HRQOL	-1.07	.31	12.19	1	.00	.34
	Social Relationships	-.19	.21	.85	1	.36	.83
	Environmental HRQOL	1.29	.30	19.14	1	.00	3.65
	Self-Efficacy	.38	.31	1.51	1	.22	1.46
	Intrinsic Value	.35	.33	1.15	1	.28	1.42
	Test Anxiety	-.04	.18	.06	1	.81	.96

Notes: Nagelkerke $R^2 = .28$ for block 1, Nagelkerke $R^2 = .29$ for block 2, Nagelkerke $R^2 = .39$ for block 3, Nagelkerke $R^2 = .40$ for block 4

Table 1. Detailed binary logistic regression statistics in predicting career intention (doctor; other) for blocks 1 to 4

D. Means comparisons and correlations with targeted variables (post hoc analyses)

To investigate differences further we computed mean comparison statistics for the measures used to predict the dependent variable, career intention. The purpose of Table 2 was to appraise direction of difference and to identify confounders that may be influential in the model. Table 2 includes mean and standard deviation comparisons between the two cohorts under investigation. Table 2 also provides information on confidence intervals and inferential statistics to ascertain the level and significance of difference. According to the findings shown in Table 2, there are several variables that showed significant differences ($p < .004$, with a Bonferroni adjustment put in place, Field, 2013), and these included grade attainment, enjoyment of competition,

environmental HRQOL and motivational beliefs (self-efficacy and intrinsic value). The findings, in Table 2, indicate that students intending to study medicine: obtained higher grades scores, enjoyed competition more, had higher environmental HRQOL, were more self-efficacious and intrinsically valued their studies more.

To investigate the interaction effect of perceived stress and Physical HRQOL as potential influential variables, a series of correlations were conducted with the 'significant' variables that emerged from the mean comparisons (Table 2). We noted (Table 3) that Physical HRQOL was positively correlated with all targeted variables, and Perceived Stress was negatively correlated with all variables ($p < .001$).

Measures	Career intention				<i>t</i>	<i>df</i>	<i>p</i>	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
	Non-doctor		Doctor							Lower	Upper
	<i>F</i> =122, <i>M</i> =34		<i>F</i> =131, <i>M</i> =34								
Gender	Mean	<i>SD</i>	Mean	<i>SD</i>							
Age	19.00	3.37	18.89	2.21	-.38	337	.71	-.11	.31	-.72	.49
Bioscience mark	4.42	2.49	6.77	2.04	9.55	337	.00	2.35	.25	1.87	2.84
Enjoyment of Competition	2.90	0.84	3.25	0.9	3.66	337	.00	.35	.09	.16	.53
Contentiousness	3.28	0.95	3.16	0.92	-1.20	337	.23	-.12	.10	-.32	.08
Perceived Stress	3.04	0.72	3.01	0.75	-.40	337	.69	-.03	.08	-.19	.12
Physical HRQOL	3.72	0.58	3.71	0.65	-.14	337	.89	-.01	.07	-.14	.12
Psychological HRQOL	3.21	0.64	3.34	0.62	1.82	337	.07	.12	.07	-.01	.26
Social Relationships HRQOL	3.41	0.8	3.44	0.73	.34	337	.73	.03	.08	-.14	.19
Environment HRQOL	3.55	0.69	3.79	0.57	3.56	337	.00	.24	.07	.11	.38
Self-Efficacy	3.11	0.66	3.56	0.65	6.34	337	.00	.45	.07	.31	.59
Intrinsic Value	4.07	0.5	4.29	0.52	3.99	337	.00	.22	.06	.11	.33
Test Anxiety	3.31	1.02	3.03	0.96	-2.61	337	.01	-.28	.11	-.49	-.07

Table 2. Descriptive statistics for career intention and the measures used in the binary logistic regression analysis with t-test comparisons for each measure (except gender)

	Environmental HRQOL	Self-Efficacy	Intrinsic Value	Grade
Perceived stress	-.47*	-.40*	-.21*	-.25*
Physical HRQOL	.60*	.29*	.19*	.21*

Note: * $p < .001$

Table 3. Pearson correlation between perceived stress and physical HRQOL with targeted variables environmental HRQOL, self-efficacy, intrinsic value, and grade

IV. DISCUSSION

The present study surveyed students in their first year of study at an Auckland university. These students were studying in the Biomedical Common Year or Overlapping Year 1 where students have differing career paths in addition to choosing a medical option (The University of Auckland, 2015a). To apply for medicine, a competitive grade average needs to be attained (The University of Auckland, 2015b). In this study, we compared students intending to study medicine versus other health-oriented careers with respect to 12 variables that included grade attainment, demographic measures, level of competition, perceived stress, HRQOL, and motivational beliefs. These variables were included because of their salience in the literature. The results of the binary logistic regression indicated the 12 variables in Block 4 explained 40% of the variance, although only four of the individual variables were found to be significant predictors of career intention, namely grade achievement, perceived stress, physical health-related quality of life, and environmental HRQOL. Also of note was that enjoyment of competition was a significant predictor at Block 3 and indicated significant differences at the individual comparison level between the two groups.

Our first approach incorporated the use of a binary logistic regression to ascertain which of the dependent variables could explain the differences in those students wanting to be a doctor in contrast to those students not intending to study medicine. We then checked the magnitude of difference using a set of independent sample t-tests. The second analyses revealed that two variables, perceived stress and physical HRQOL, yielded non-significant differences and hence could be influential or 'confounding' variables. Finally, we computed correlational analyses for perceived stress and physical HRQOL versus those variables that were found to be significantly different on the t-test comparisons. The purpose of this approach was to tease out any interactions produced by perceived stress and physical HRQOL. The outcome being that perceived stress and physical HRQOL were likely moderating variables impacting on, and potentially masking the 'true' effect, of environmental HRQOL, self-efficacy, intrinsic value, and grade achievement. These subtle influences will be discussed in more depth in due course.

Grade achievement is clearly a strong variable for determining differences between those intending to be a medical student versus those intending to study other health-oriented programmes. This result was expected given the need to achieve high grades to be considered for admission at the University of Auckland (The University of Auckland, 2015b) and elsewhere (Al Alwan et al., 2013; McManus et al., 2005; Shulruf et al., 2012). The rationale for selecting the grade average criteria is that it will likely predict success of students later in their medical course and career as a practicing doctor (McManus et al., 2005; Shulruf et al., 2012). One area that may extend this argument is that of the academic self-concept (Marsh & Seaton, 2013), which suggests that students have awareness of their academic level and this awareness can assist them in positioning themselves for entry into highly competitive courses like medicine.

Enjoyment of competition is an interesting predictor variable as it has several implications. In their development of the instrument, Houston, Harris, McIntire, and Francis (2002) described enjoyment of competition in terms of students who liked competition, who felt they were competitive by nature, enjoyed competing against others, got satisfaction from competition, and aimed to outperform others. With this in mind, and in considering the Block 3 and individual results, we found that those intending to be medical students scored higher on these attributes than their non-medical peers. Competitiveness could be viewed as a personality trait or a strategy needed to be successful in choosing a career in medicine in order to gain an edge on other students who may have the same goal (Fincher et al., 1992; Hilliard, 1995). In addition, 54% of our sample had a desire to study medicine which may suggest that over 700 students in the population in the Biomedical Common Year 1 may have an interest in studying medicine. We have no idea if this extrapolation is verifiable; although the allocated places of 270 students (Health Workforce New Zealand, 2011) is likely well below those students aiming to study medicine, thus increasing the need to be highly competitive to enter in the medical programme.

The issue for educationalists is how to transform this level of competitiveness to one of collaboration upon transition to medicine (Reagan & Blakemore, 2009). A potential teaching and learning strategy would be to promote group work that engenders the culture of working with

heterogeneity, openness and constructive problem solving (Staples, 2008). The question arises as to whether this level of competitiveness is maintained in further years of study after the students are selected into medicine. There is some literature to suggest that this competitive spirit is required later on in the study of medicine, for example when students aim for surgery (Glynn & Kerin, 2010). In addition to the need to be competitive, Glynn and Kerin found that students focussed on surgery because of influences from role models and the need for prestige. Lifestyle and stress were also determinants that predicted students not wanting to pursue surgery. This suggests that stress and lifestyle (which could be aspects of quality of life) impact students' perceptions of a potentially competitive discipline environment. It is important to note though, that there is evidence to suggest that competitiveness declines over time in the medical learning environment and that intrinsic forms of motivation may become more important, i.e., the need to be a good doctor (Hilliard, 1995).

In relation to the Block 4 model, the variables perceived stress, physical HRQOL and environmental HRQOL were able to significantly contribute to the model. At an individual level (Table 2) only environmental HRQOL was found to be significantly different, thus indicating that perceived stress and physical HRQOL are confounding influences that indirectly affect other variables in their prediction of career intention. This was further verified by the correlational analysis (Table 3). Nonetheless, environmental HRQOL was a significant variable in both the model and in the individual analyses. Environmental HRQOL measures feelings of safety, access to health and transportation resources, satisfaction with physical environment and housing, financial and informational resources, and opportunity for leisure activities (WHOQoL Group, 1998). Skevington, Lofy, and O'Connell (2004) suggest that the concept of environment, as a HRQOL construct, is likely related to levels of satisfaction about accessing the resources within one's environment that can promote wellbeing. Hence, ample access to these resources may be highly correlated with affluence, suggesting that students intending to study medicine may have greater resource access than students not intending to study medicine. This assumption is consistent with studies showing that the cost of studying medicine is high compared to other courses and many medical students do tend to come from more affluent backgrounds (Collins, Jones, & White, 1993; Ng, Tambyah, & Wong, 2009). It is acknowledged though that there is some qualitative evidence to suggest that year 4 and 5 medical students express similar concerns to other students about their environmental HRQOL, such as worries about the use and access of adequate public transport (Henning, 2010).

The non-significant variables in the Block 4 model

included aspects of competition (enjoyment and contentiousness), social relationships, and motivational beliefs (self-efficacy, intrinsic value, and test anxiety). The results shown in Table 2 suggest that perception of enjoyment of competition and the motivational beliefs variables significantly differ between those students intending to enrol in medicine versus those intending to enrol in other health-oriented courses. The differences between the model and the individual statistics suggest that perceived stress and physical HRQOL are moderating the effects of enjoyment of competition and the motivational beliefs. It may appear that students intending to study medicine are more self-efficacious, see their studies as more intrinsically valuable, enjoy competition more and are potentially less test-anxious. Nonetheless, our findings appear to show that this is only true for certain conditions or combinations of perceived stress and physical HRQOL (likely low stress and high physical HRQOL).

The major limitation of this study is the response rate of 25%, although this is considered reasonable for an online survey (Nulty, 2008; Sax, Gilmartin, & Bryant, 2003). It is further noted that more female students responded to the survey than male students, and this was expected given that more women study medicine in New Zealand than men and this could be as high as a 65 to 35 percent split suggesting a feminisation of medicine in New Zealand (Fitzjohn, Wilkinson, Gill, & Mulder, 2003; Poole, Moriarty, Wearn, Wilkinson, & Weller, 2009). Nonetheless, it is acknowledged that there is a likely response bias in the results and the study gathered information regarding their intention to study medicine and their self-disclosed grades rather than departmentally recorded grades. However, given the anonymous nature of the study it is unlikely students would intentionally mislead the researchers. Further studies may wish to unpack the influence of perceived stress and physical HRQOL on students' enjoyment of competition and motivational beliefs. Further studies could also consider how students' academic performance (e.g., bioscience grade) scores affect measures of motivation and HRQOL, which could enhance the interpretation and robustness of the results and predictions on future performance in medicine. Other variables worthy of consideration include evaluating the impact of critical thinking skills, levels of certainty, social or emotional intelligence, and interpersonal skills.

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Declaration of Interest

This is an unfunded study. All authors have no potential conflicts of interest.

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