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ORIGINAL ARTICLE

The association between perception of patients and their actual ability to do floor activities after mobile-bearing unicompartmental knee arthroplasty: A prospective, cross-sectional study

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Arthroplasty of the knee is one of the most successful orthopedic reconstructive procedures.[1,2] The main goal is to relieve disabling pain, correct deformities, and improve knee functions, all of which may lead to improved quality of life. Previous studies have shown that most patients can achieve these goals.[2,3] Nonetheless, improvement in floor activities after knee arthroplasty, which is critical for Asians and Muslims with regards to their daily lifestyles and religious activities, has not been well-established in previous literature.[4-8]

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ABSTRACT

Objectives: This study aims to evaluate the association between patients' perception and their ability to perform floor activities after mobile-bearing unicompartmental knee arthroplasty (MB-UKA).

Patients and methods: This prospective, cross-sectional study included a total of 63 knees of 63 patients (7 males, 56 females; mean age: 65.6±6.2 years; range, 51 to 79 years) with anteromedial osteoarthritis knee who had MB-UKA with a follow-up period of at least one year postoperatively. Each participant was asked to rate their perception of their ability to perform six floor activities. Their actual abilities were measured by using a five-category anchored scale. The primary outcome was the association between participants' perception and their actual ability. The secondary outcome was to evaluate factors affecting patients' actual ability.

Results: More than 60% of the patients could achieve good actual ability scores in performing chair kneeling, floor kneeling, and sitting side-legged regardless of their perception. Chair kneeling at 90 degrees had the most patients (69.8%) with good actual ability scores. Standing up from the floor was the activity with the highest positive perception rate of 84.1%. However, relatively lower actual activity scores were observed in floor squatting, cross-legged sitting, and standing up from the floor. Floor squatting yielded the lowest rate of positive perception and actual ability scores (39.1% and 20.6%, respectively). The Oxford Knee Score and knee flexion angle had moderate positive correlations with the actual ability scores (r=0.44 and 0.40, respectively).

Conclusion: Patients' perception and their actual ability may differ for each floor activity after MB-UKA. An appropriate sequence of activities based on their difficulties along with positive reinforcement and appropriate patient education may yield favorable functional outcomes following MB-UKA.

Keywords: Floor activities patient perception, unicompartmental knee arthroplasty.

As many as 50 to 80% of patients have reported an inability to return to perform such activities after total knee arthroplasty (TKA).[9-11] The mobile-bearing unicompartmental knee arthroplasty (MB-UKA) was first introduced in 1982 based on concepts of minimally invasive surgery to preserve natural knee structures.[12] The technique has yielded satisfactory outcomes for more than two decades.[13-17] In general, UKA candidates are younger and more active with better baseline range of motion (ROM) and less severe deformities than candidates for TKA.[18] Accordingly, patients post-UKA are expected to perform better gait and activities than those post-TKA.[19] Factors such as fear of damaging the prosthetic device, scar pain, and inadequate postoperative instruction may hinder a patient's perceived capability to engage in floor activities following surgery. Previous studies have shown that patients' actual ability to kneel after knee arthroplasty can be mismatched with their perception.[6,20] To date, no study has investigated whether patients' perception is associated with their actual ability to perform various floor activities position after UKA surgery.

In the present study, we aimed to evaluate the possible association between patients' perception and their actual ability to perform floor activities after MB-UKA and to identify factors affecting patients' actual ability.

PATIENTS AND METHODS

This single-center, prospective, cross-sectional study was conducted at Department of Orthopaedic Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, Thailand between March 2016 and July 2021. Patients with anteromedial osteoarthritis knee who had MB-UKA performed with a follow-up period of at least one year postoperatively were eligible for inclusion. The exclusion criteria were as follows: having secondary osteoarthritis of the knee (i.e., post-traumatic, post-infectious, inflammatory, and crystal-induced osteoarthritis); having postoperative complications such as periprosthetic fractures and knee instability; and having spine or contralateral knee problems causing limited knee functions. Finally, a total of 63 knees of 63 patients (7 males, 56 females;



FIGURE 1. Description of floor activities; **(a)** Chair kneeling at 90-degree flexion, **(b)** Chair kneeling at 120-degree flexion, **(c)** Floor kneeling at 90-degree flexion, **(d)** Floor kneeling at 120-degree flexion, **(e)** Side-legged sitting, **(f)** cross-legged sitting, **(g)** Floor squatting.

TABLE I
The scoring system to evaluate actual ability of patients to perform floor activities

0	Inability to perform the activity
1	Can perform the activity with substantial difficulty (visual analog pain score >3 and duration to successful performance >10 seconds)
2	Can perform the activity with moderate difficulty (visual analog pain score >3 or duration to successful performance >10 seconds)
3	Can perform the activity with mild difficulty (no pain and duration to successful performance 6-10 seconds)
4	Can perform the activity without difficulty (no pain and duration to successful performance <5 seconds)

mean age: 65.6±6.2 years; range, 51 to 79 years) were included in the study.

Study procedure

All patients underwent MB-UKA by qualified arthroplasty surgeons. Postoperatively, the patients were scheduled for regular follow-up visits as per the standard protocol. At the index visit, the patients were asked whether they could perform each of the six floor activities, which were chair kneeling, floor kneeling, floor squatting, sitting cross-legged, sitting side-legged, and getting up from the floor (Figure 1). Their response options were either Yes or No. The 12-item Oxford Knee Score (OKS)[21] was also collected, as well as the patients' baseline characteristics and demographics. After assessing the participants' perception, a trained investigator recorded the participants' active ROM in full knee flexion and extension. We used a long double-arm goniometer to measure the ROM while the participants were in a supine position. Also, the investigator evaluated the participants' actual ability to perform floor activities in eight positions, which were chair kneeling at 90 and 120 degrees of flexion, floor kneeling at 90 and 120 degrees of flexion, floor squatting, sitting cross-legged, sitting side-legged, and getting up from the floor. Floor kneeling was evaluated at 90 and 120 degrees of flexion using a similar sequence as that of chair kneeling. Floor squatting, sitting cross-legged, sitting side-legged, and getting up from the floor were evaluated sequentially with a 1-min break between each activity. A self-invented scoring system was employed to determine the level of patients' actual ability. The scale is five-category anchored scale ranging from 0 to 4 (Table I). For comparing the actual ability (score 0-4) to the patient's perception (Yes/No) for each of floor activities evaluation, we categorized the scale score into binary variable "good ability" (a score of 3 to 4) or "poor ability" (a score of 0 to 2) to simplify statistical analysis. There was a single outcome assessor performing all the evaluations in this study.

Study outcomes

The primary outcome of the study was to evaluate whether there was an association between the participants' perception and their actual ability to perform floor activities after MB-UKA. The secondary outcome was to identify factors associated with the participants' ability to perform floor activities.

Statistical analysis

Statistical analysis was performed using the PASW version 18.0 software (SPSS Inc., Chicago, IL, USA). Descriptive data were expressed in mean ± standard deviation (SD), median (min-max) or number and frequency, where applicable. An

TABLE II
Demographic and clinical characteristics of patients

Characteristics	n	%	Mean±SD
Age (year)			65.6±6.2
Sex			
Female	56	88.9	
Height (cm)			157.3±7.2
Weight (kg)			69.1±9.4
Body mass index (kg/m^2)			27.9±3.4
Operated knee			
Left	27	42.9	
Right	36	57.1	
Post-operative period (months)			32.1±15.2
Knee functions			
Full knee extension angle			2.4±3.7
Full knee flexion angle			115.7±11.5
Oxford knee score			42.7±3.8

SD: Standard deviation.

TABLE III
Perception of floor activities and actual activity score category

	Perception				Actual ability				
	No		Yes		Poor		Good		
Floor activities	n	%	n	%	n	%	n	%	*p*
Chair kneeling 90°	28	44.4	35	55.6	19	30.2	44	69.8	<0.0001
Chair kneeling 120°					25	39.7	38	60.3	<0.0001
Floor kneeling 90°	34	54	29	46	25	39.7	38	60.3	0.001
Floor kneeling 120°					32	53.3	31	46.7	0.004
Floor squatting	39	61.9	24	38.1	50	79.4	13	20.6	0.009
Cross-legged sitting	33	52.4	30	47.6	39	61.9	24	38.1	<0.0001
Side-legged sitting	29	46	34	54	25	39.7	38	60.3	<0.0001
Standing up from the floor	10	15.9	53	84.1	37	58.7	26	41.3	0.004

association between the participants' perception as a Yes or No response and their actual ability to perform each floor activity categorized as good or poor ability was assessed with the chi-square test of independence. We also performed the chi-square tests for trend using the Cochran's and Mantel and Haenszel statistics. The Spearman rank correlation was used to identify relevant patients' characteristics and demographics correlated with their actual ability to perform floor activities. Correlation coefficients (r) <0.3, 0.3 < r < 0.5, and r > 0.5 were considered weak, moderate, and strong, respectively. Factors assessed were age, body mass index (BMI), the OKS, and the knee flexion angle (KFA). A *p* value of <0.05 was considered statistically significant.

RESULTS

The demographic and clinical characteristics of the patients are presented in Table II. The mean follow-up period after MB-UKA was 32.1±15.2 (range, 12 to 63) months. The mean KFA and OKS were 115.7±11.5 and 42.7±3.8, respectively.

The participants' perception of their ability to perform each floor activity is presented in Table III. Their actual ability scores for each activity are illustrated in Figure 2, and the categorizations based on good or poor classification are presented in Table III. The mean sum of scores for all activities was 16.9±10.6. More than 60% of all the participants could achieve good actual ability scores in performing chair kneeling, floor kneeling, and sitting side-legged regardless of their perception. However, relatively lower actual ability scores were observed in floor squatting, cross-legged sitting, and standing up from the floor. We found that some patients may have underestimated their abilities in certain floor activities, leading to a discrepancy between their perception and their actual performance. There was a mismatch between patients' actual abilities and their perceptions of various floor activities. Chair kneeling at 90 degrees had the highest proportion of patients with good actual ability scores (69.8%), which was higher than the proportion of patients with positive perceptions (55.6%). Conversely, standing up from the floor had the highest positive perception rate (84.1%). However, only 41.3% of patients demonstrated good actual ability in this activity. The activity with the lowest proportion of patients with positive perception and good actual ability scores was floor squatting (39.1% vs. 20.6%, respectively). We found statistically significant associations between the participants' perception and their actual ability to perform all the floor activities assessed in eight positions from the analyses with both good or poor categorizations (Table III) and trends (Figure 2).

In evaluating factors affecting the patients' actual ability to perform floor activities, we found that the OKS and KFA had a moderate positive correlation with the actual ability scores (r=0.44 and 0.40, respectively) (Table IV). In other words, the higher the OKS and KFA, the higher the actual ability scores the patients could achieve. On the other hand, age and BMI had fair and weak negative correlations, respectively, with the actual ability scores (r= -0.3 and -0.15, respectively), demonstrating that older age and higher BMI were correlated with poor actual ability scores (Table IV).

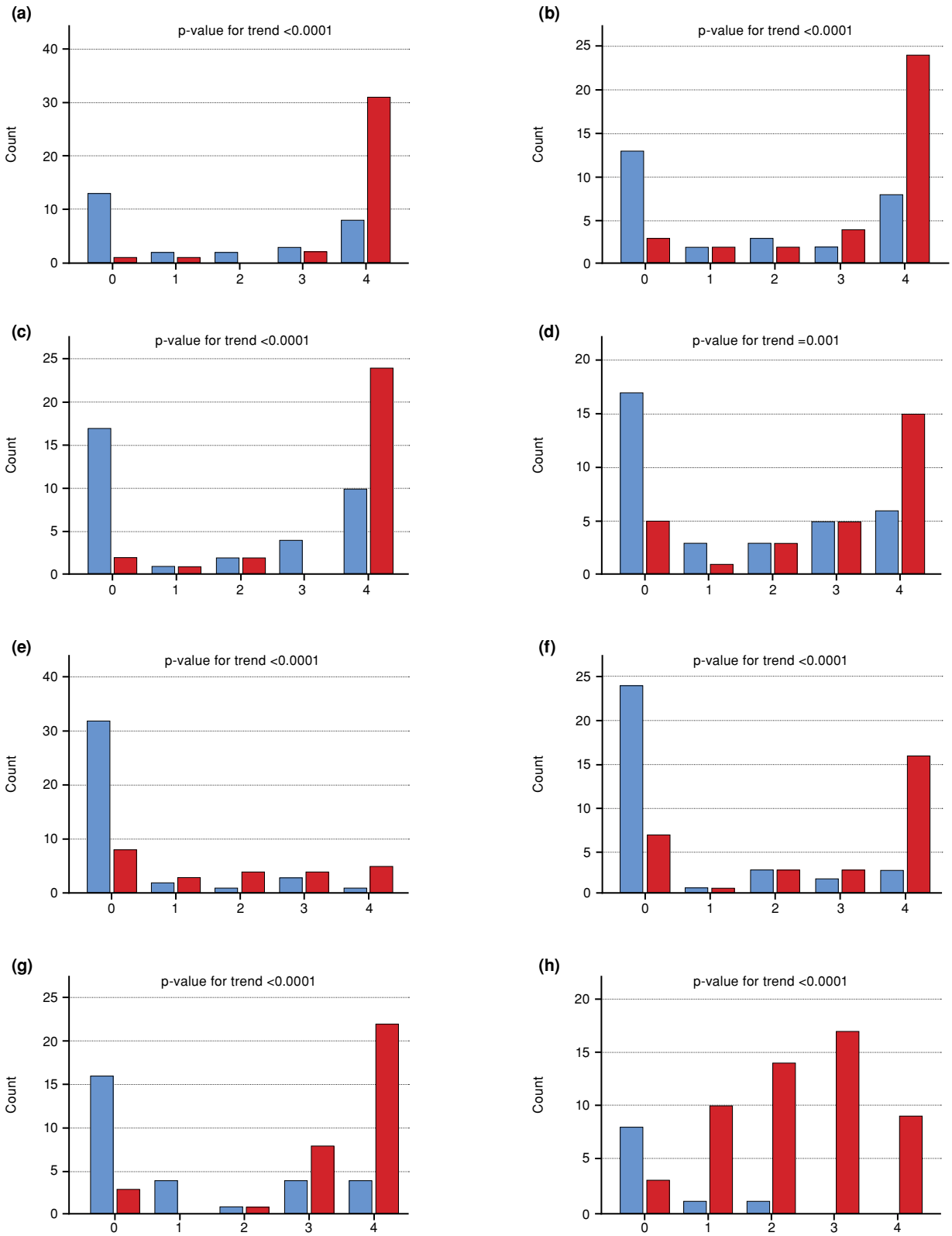


FIGURE 2. Distribution of actual activity scores among patients perceived that they could (red bars) and could not (blue bars) perform floor activities; **(a)** Chair kneeling at 90-degree flexion, **(b)** Chair kneeling at 120-degree flexion, **(c)** Floor kneeling at 90-degree flexion, **(d)** Floor kneeling at 120-degree flexion, **(e)** Floor squatting, **(f)** cross-legged sitting, **(g)** Side-legged sitting, **(h)** Standing up from the floor.

TABLE IV
Factors affecting patient's abilities to perform floor activities

Factors	Spearman rank correlation	*p*
Oxford knee score	0.44	<0.0001
Body mass index	-0.15	0.25
Age	-0.30	0.02
Knee flexion angle	0.40	0.001

DISCUSSION

Activities of daily living in the Eastern population are extremely different from that of the Western.[4] In Western countries, most studies on functional outcomes after knee arthroplasty usually focus on activities involving kneeling. Whereas in Muslims and Asians, most cultural and religious activities are performed on the floor in positions such as cross-legged sitting, side-legged sitting, and squatting.[8,9] Nonetheless, studies focusing on these activities in relevant populations are limited. Although various attempts have been made to improve kneeling ability in the western population, outcomes related to this activity after TKA were still unsatisfactory. As demonstrated in a recently-published review by Wylde et al.,[11] the rate of difficulty kneeling or inability to kneel was as high as 60 to 80%. Also, a discrepancy between patients' perception and their observed ability to kneel has been documented by Schai et al.[20] who revealed that although only 56% of patients perceived that they could kneel, 80% were actually able to kneel upon functional evaluations.

Due to multiple distinct properties of UKA, favorable outcomes with regards to floor activities have been anticipated, yet the evidence was limited. Hassaballa et al.[6] observed kneeling activities in 53 patients who underwent TKA, fixed-bearing UKA, or patellofemoral arthroplasty. The study showed that 84.9% and 50.9% of the patients could kneel at 90 and 120 degrees, respectively; however, only 39.9% perceived that they could. Nonetheless, the study included a mixed population of multiple surgical procedures, thus limiting the conclusiveness of the evidence on the efficacy of UKA. Furthermore, activities were not evaluated in multiple relevant positions, nor multiple-category anchored scales were obtained for their measurements.

This study included a cohort with characteristics comparable to those of the largest and most recent study of MB-UKA in Thailand by Ruangsomboon et al.[22] However, this study was the first to specifically focus on the ability of patients post-MB-UKA to perform floor activities and the relationship with their perception. Interestingly, we found that chair kneeling was the position that most participants could achieve good actual ability scores. Patients also underestimated their ability to perform this activity. Additionally, among those who perceived that they could not chair kneel, 39.3% still received good actual ability scores. Therefore, this activity was by far the easiest one and should be considered the first activity to rehabilitate patients. Also, it may be the safest activity for patients to self-practice before attempting other more complicated, challenging, and potentially harmful activities. Moreover, the present study demonstrated that chair kneeling at 120 degrees and floor kneeling at 90 degrees could yield similar rates of good actual ability scores, both of which were higher than the rates of positive perception. Consequently, from our study, a sequence of activities for rehabilitation can be tailored starting from the lowest to the highest level of difficulty, which were chair kneeling at 90 degrees, chair kneeling at 120 degrees, floor kneeling at 90 degrees, and floor kneeling 120 degrees. Patients should be also encouraged to perform these activities, since they may perform better than how they perceive and expect.

On the other hand, floor squatting was the most difficult activity to perform successfully with the lowest scores evaluated by both the patients' own perception and their actual ability. Moreover, almost half of the participants who perceived that they could squat did not receive good actual ability scores. Therefore, it should be the last activity to practice and be preserved for patients with relatively higher muscle strengths.

Cross-legged and side-legged sitting are the prominent positions that Asians perform in religious activities. From the present study, we observed that side-legged sitting was easier to perform than cross-legged sitting. Also, there were more participants with good actual ability scores on side-legged sitting than those perceived accordingly, which is inconsistent with the finding of cross-legged sitting.

Although standing from the floor was the activity that most participants had a positive perception towards, the proportion of participants with good actual ability scores was only about half the proportion with positive perception. Indeed, approximately half of those who perceived that they could perform the activity had a score of two, indicating that they faced

more difficulty and pain, or it took them longer to perform than estimated.

In addition, we discovered that the OKS and KFA were moderately and favorably linked with the participants' actual floor activity performance. However, we were unable to identify a predictor component with a substantial correlation of success. This may have occurred, as such capacity was dependent on several factors that we did not gather, or as the sample size of the study was insufficient to discover a meaningful predictor. In particular, OKS and KFA were found to be linked with 90-degree chair kneeling and floor kneeling, respectively. These findings suggest that OKS and KFA may be beneficial for evaluating the functional outcomes of UKA surgery, particularly in regard to particular activities. However, it is crucial to highlight that OKS and KFA were not highly connected with all of the activities evaluated in this study, and additional research is necessary to fully appreciate the efficacy of these measures for assessing UKA functional outcomes. Patient-reported outcome measures (PROMs) are subjective assessments of a patient's functional status, whereas objective measures such as the OKS and KFA provide more objective assessments of functional ability. The PROMs can provide valuable insights into a patient's perceived functional status, but these perceptions may not always accurately reflect a patient's actual ability. The results of this study suggest that OKS and KFA may be useful in evaluating the functional outcomes of UKA surgery, as they were found to be moderately and positively correlated with the participants' actual ability to perform certain floor activities. However, additional research is needed to fully understand the utility of these objective measures in evaluating UKA functional outcomes.

In our study, we did not specifically evaluate the association between age, BMI, and perception of ability to perform floor activities after UKA surgery. However, a previous study indicated that these factors could impact patients' perceived abilities and self-reported outcomes.[23] Therefore, it would be valuable for future studies to investigate the relationship between age, BMI, and perception to more fully understand the factors that may influence patients' perceived abilities and self-reported outcomes following UKA surgery.

Nonetheless, there are several limitations to the present study. First, it is a cross-sectional study conducted in a single center using a single implant design, limiting the generalizability of the study findings. Second, the sample size of the study is relatively small. Although significant associations and trends were seen, further studies with more patients are still mandatory, particularly for identifying factors affecting the actual abilities. Third, evaluating perception as a binary independent variable while evaluating functional evaluation in four categories and, then, converting it to a binary variable may introduce limitations that affect the reliability and interpretability of the results. It is important to consider these limitations while interpreting our findings and comparing the results to other researches. Finally, we invented both the scoring system and the eight functional positions, but none of them were validated.

In conclusion, an ability to perform floor activities is an important expectation for Asian patients after knee arthroplasty. Patients' perception and actual ability may differ for each floor activity, and a suitable sequence of activities based on difficulty may improve patients' practice and effectiveness.

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Ethics Committee Approval: The study protocol was approved by the Siriraj Institutional Review Board Ethics Committee (date: 11.03.2016, no: 009/2559[EC4]). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Trial registration: The study was approved by the Institutional review board of Siriraj Hospital, Mahidol University [SIRB 009/2559(EC4)].

Patient Consent for Publication: Informed consent was obtained from all individual participants included in the study. All participants had given approval for the study for publishing their data and all participants provide informed consent to publication of identifying information/image in an online open-access publication.

Data Sharing Statement: The datasets generated and/or analyzed during the current study are not publicly available. These datasets were stored in our internal high-security level hard drive but are available from the corresponding author on reasonable request. Requests for data not shown in the body of this manuscript can be made to the corresponding author.

Author Contributions: Provided research questions, write manuscript and rebuttal: R.N.; Contribute to full manuscript development and rebuttal: P.R.; Conducted data collection, analyzed data and discussion and developed the draft manuscript: K.R.; Examined all data analysis, detailed the results, statistical calculation, monitored data and discussion: C.P.; Also provided useful advice and finalize the manuscript: K.C. All authors have read and approved the final submitted manuscript.

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