

**Psychological symptoms in adults prior to Royal Prince Alfred Hospital
Elimination Diet prescription: exploring associations with diet-related factors
and validating a screening tool**

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Abstract

Aim: Psychological symptoms can impair adherence to many health prescriptions, including restrictive diets. This study assessed depression, anxiety and eating disorder symptoms in adults presenting to the Royal Prince Alfred Hospital (RPAH) Allergy Unit with suspected food intolerance and examined the association between these psychological symptoms and presenting symptoms, suspected dietary triggers and the level of RPAH Elimination Diet prescribed. The validity of the RPAH Allergy Unit Assessment Form (R-AF) as a screening tool for psychological symptoms was also assessed.

Methods: A cross-sectional study was conducted on adult RPAH Allergy Unit patients prior to commencing the RPAH Elimination Diet. Psychological symptoms were measured using validated questionnaires.

Results: The mean and standard deviation for depression, anxiety and eating disorder questionnaire scores of study patients (n = 42) were comparable to the general population. Psychological symptoms did not appear to be associated with patients' presenting symptoms, suspected dietary triggers or the level of RPAH Elimination Diet prescribed. Several patients' self-reported anxiety status or eating disorder status were discordant with scores from corresponding psychological questionnaires, while self-reported depression status was comparatively more agreeable with the validated depression questionnaire.

Conclusions: The level of RPAH Elimination Diet prescribed did not appear to be associated with psychological symptoms which can impair adherence. This reinforces the importance of screening to identify patients with such symptoms and

subsequently implement strategies to improve adherence. The R-AF appears promising for screening patients for depression symptoms, but may not be an effective screening tool for anxiety and eating disorder symptoms.

Key words: food hypersensitivity, psychological factors, validation studies.

Introduction

Pharmacological food intolerance (food intolerance) describes a non-immune adverse reaction to food chemicals, some of which are naturally occurring such as salicylate, amines and glutamate, while others are artificially added such as colours and preservatives. The adverse reaction is thought to result from irritation of nerve endings by food chemicals in a dose-dependent manner, manifesting as respiratory, skin, gastrointestinal and/or central nervous system (CNS) symptoms in sensitive individuals. The age of onset, symptom presentation and prognosis for food intolerance are all variable, often to the frustration of patients.¹

Food intolerance is not an immune-mediated response and therefore cannot be diagnosed in the same way as a food allergy. Instead, an elimination diet is prescribed to remove and/or significantly reduce the intake of chemicals associated with food intolerance, followed by systematic challenges with each chemical to identify the specific compound(s) causing the intolerance reaction.² In Australia, many patients with food intolerance are diagnosed this way at the Royal Prince Alfred Hospital (RPAH) Allergy Unit using the RPAH Elimination Diet.

The RPAH Elimination Diet can be prescribed at one of three levels of decreasing restriction: 'Strict', 'Moderate' and 'Simple'. The 'Strict' prescription maximises the likelihood of diagnosis, but also requires the greatest degree of dietary restriction.³ Patients frequently struggle to adhere to the RPAH Elimination Diet and other restrictive diets for adverse reactions to food, hindering an accurate diagnosis and/or symptom resolution.^{4,5} In order to optimise both diagnosis and adherence, dietitians must therefore consider factors such as patients' symptoms, suspected dietary triggers

and ability to adhere to dietary restrictions when selecting the level of RPAH Elimination Diet to prescribe.³

Depression, anxiety and eating disorder symptoms can significantly impair patients' capacity to adhere to many health prescriptions and dietary restrictions,^{4,6,7} including the RPAH Elimination Diet.⁵ In RPAH Elimination Diet patients, these psychological symptoms may not be associated with presenting symptoms, and it has not been clearly established whether psychological symptoms are associated with suspected dietary triggers.⁵ Both presenting symptoms and suspected dietary triggers are likely to influence the level of RPAH Elimination Diet prescribed, and subsequently the degree of dietary restriction a patient must adhere to.³ It is therefore necessary to clarify the nature of psychological symptoms in adults prescribed the RPAH Elimination Diet in order to develop and implement effective strategies to improve adherence. A screening tool is also essential to identify patients with these psychological symptoms, as patients' poor adherence is not typically preceded by a lack of expressed intention to adhere.⁴ Currently the RPAH Allergy Unit Assessment Form (R-AF) is available to screen patients at the RPAH Allergy Unit for anxiety, depression and eating disorder symptoms, however its validity is unknown.

This study aims to characterise depression, anxiety and eating disorder symptoms in adults with suspected food intolerance and explore whether these psychological symptoms are associated with presenting symptoms and suspected dietary triggers prior to being prescribed the RPAH Elimination Diet at the RPAH Allergy Unit. This study also aims to investigate correlations between these psychological symptoms and the level of RPAH Elimination Diet prescribed. Further, this study aims to

examine the validity of the R-AF in characterising patients' depression, anxiety and eating disorder symptoms and therefore its potential as a screening tool.

Methods

This cross-sectional study is part of a five-year prospective observational study on nutritional adequacy and dietary compliance of patients prescribed the RPAH Elimination Diet at the RPAH Allergy Unit. The broader protocol complied with the 2008 Seoul amendment of the Declaration of Helsinki and was approved by the RPAH Ethics Review Committee.

Adults (≥ 18 years old) attending an initial appointment at the RPAH Allergy Unit over a two-month period in 2014 were contacted by telephone approximately one week before their appointment. Three contact attempts per patient were permitted. Student dietitians interviewed patients to identify those with potential food intolerance and invite them to receive further information and volunteer for the study.

Participants were provided instructions to complete a four-day Weighed Food Record (WFR) prior to their initial appointment. Submission of the WFR and study questionnaires constituted consent. At their initial appointment, patients completed the R-AF, Beck Depression Inventory ii (BDI-II), State-Trait Anxiety Index Y1 form (STAI) and Eating Disorder Examination Questionnaire (EDE-Q) before being prescribed the RPAH Elimination Diet. Study data were not made available to dietitians, to prevent any influence on the level of RPAH Elimination Diet prescribed. Patients who did not see a dietitian for the RPAH Elimination Diet or did

not complete the R-AF and at least one of the psychological questionnaires were discontinued from the study.

The R-AF is a 16-page form used to collect medical, dietary and psychological information on patients at their initial appointment at the RPAH Allergy Unit. Patients self-reported their anxiety, depression and eating disorder status ("current", "past" or "never") on the R-AF. The R-AF has not been assessed for validity or reliability.

The BDI-II is a valid and reliable tool to screen for clinical depression in a range of populations.^{8,9} Patients select one of four statements that best describes their experience of each of 21 depression symptoms over the past two weeks. Patients' answers to seven BDI-II questions form a BDI-Primary Care (BDI-PC) score which minimises exaggerated scoring from physical illness symptoms, providing superior validity and reliability.¹⁰ A BDI-II score of <10 results in very high sensitivity, likely to be further heightened in populations with symptoms from physical illness, thus providing a conservative cut-off below which patients are unlikely to have clinically significant depression.⁹ BDI-II scores were used for this cut-off, however BDI-PC scores were used for all other analyses of depression symptoms. A BDI-PC score >5 results in very high specificity, providing a conservative cut-off above which patients are likely to have clinical depression.¹¹

The STAI consists of two 20-statement forms assessing anxiety in the context of patients' current experience and persistent personality, respectively.¹² Patients select one of four answers of increasing agreement ranging from "not at all" to "very much so" for each statement. The STAI is agreeable with other anxiety tools in identifying

patients with "high anxiety" in adult populations.¹³ The validity and reliability of the STAI are moderate, the state- form in particular being susceptible to factors such as the physical test environment.¹² Based on STAI score norms for an adult population, cut-offs of >44 (mean + 1SD) and <26 (mean - 1SD) for state or trait scores were used to identify patients likely and unlikely of having high anxiety, respectively.¹²

The EDE-Q consists of 21 questions assessing the frequency of disordered behaviours and thoughts related to diet and body image over the previous 28 days.¹⁴ The questionnaire has good psychometric strength when used in the general population, particularly in adults.¹⁵ Patients were classified as being at high risk of having an eating disorder based on a global score ≥ 2.3 and the presence of either binge eating or compulsive exercise to control weight.¹⁶ This classification considers behaviours uncommon in individuals who do not have an eating disorder, enhancing specificity compared to a cut-off based solely on the global score.

Patients' age, gender, RPAH Elimination Diet prescription, number and type of presenting symptoms and number and type of suspected dietary triggers as documented by their physician and dietitian were extracted from the RPAH Allergy Unit electronic database. To assess the representativeness of study patients, this data was also extracted for all other adult RPAH Allergy Unit patients prescribed the RPAH Elimination Diet during the study period.

Student dietitians entered and analysed data using Microsoft Excel. Descriptive statistics (Mean, SD, percent values) were performed. Where appropriate, data from a 2013 interim study¹⁷ within the same five-year project were included in analyses.

Results

155/203 patients eligible for recruitment were reached by telephone. Of these 155 patients, 74 received further information on the study. At their initial appointment, 50 patients consented to participate in the study, 26 of whom saw a dietitian for the RPAH Elimination Diet. 22 of these patients completed the R-AF and at least one psychological questionnaire. A further 20 adult patients were included for analysis from the 2013 interim study, however self-reported psychological status data were not available for these patients as they had not completed the R-AF as part of the 2013 study protocol.

Table 1 Characteristics of study and non-study adult patients prescribed the RPAH Elimination Diet at the RPAH Allergy Unit.

Adult patients prescribed the RPAH Elimination Diet	Study patients	Non-study patients
Total n	42	142
Age (mean \pm SD)	44 \pm 14	41 \pm 14
Male n (%)	8 (19%)	38 (27%)
Number of presenting symptoms (mean \pm SD)	3 \pm 2	2 \pm 2
Number of suspected dietary triggers (mean \pm SD)	4 \pm 3	3 \pm 3
Patients with data available on the level of RPAH Elimination Diet prescribed n	41	124
Proportion prescribed the Strict, Moderate or Simple RPAH Elimination Diet n (%)	30 (73%), 9 (22%), 2 (5%)	85 (69%), 16 (13%), 23 (19%)

Study and non-study patients were similar in age, number of presenting symptoms and number of suspected dietary triggers (Table 1). Study patients were less likely to be prescribed the Simple RPAH Elimination Diet, and a higher proportion of study patients were female. The majority of study and non-study patients were prescribed the Strict RPAH Elimination Diet.

41, 40 and 31 patients completed the STAI, BDI-PC and EDE-Q respectively. Mean \pm SD scores for STAI state, STAI trait, BDI-PC and EDE-Q were 36 ± 11 , 38 ± 12 , 3 ± 3 and 1.0 ± 1.1 , respectively. 10/41 (24%) patients' STAI scores indicated a high likelihood of high anxiety, 6/40 (15%) patients' BDI-PC scores indicated a high risk of clinical depression and 3/31 patients' (10%) EDE-Q scores indicated a high risk of an eating disorder. Patients' state and trait scores for STAI were generally concordant, and differences were more often due to a higher score on the trait inventory.

Patients commonly presented to the RPAH Allergy Unit with gastrointestinal (23/42, 55%), skin (17/42, 40%) and/or CNS symptoms (14/42, 33%). Respiratory symptoms were relatively uncommon (3/42, 7%). No remarkable trends were observed between patients' STAI, BDI-PC or EDE-Q scores and the number or type of presenting symptoms. Similarly, no marked differences were seen in the distribution of STAI, BDI-PC or EDE-Q scores for patients prescribed different levels of the RPAH Elimination Diet.

Table 2 Dietary triggers suspected by patients prior to RPAH Elimination Diet prescription.

Suspected dietary triggers	Study patients (n = 42)
Gluten-containing foods	18 (43%)
Vegetables	16 (38%)
Drinks, coffee, alcohol	14 (33%)
Condiments, herbs & spices	14 (33%)
Dairy	13 (31%)
Fruit	11 (26%)
Restaurant & takeaway meals	10 (24%)
Syrups and sweets	7 (17%)
Legumes	6 (14%)
Seafood	6 (14%)
Soy	5 (12%)
Gluten-free foods	3 (7%)
Fats & oils	2 (5%)
Eggs	2 (5%)
Meat	2 (5%)
Nuts & seeds	1 (2%)

Gluten-containing foods, vegetables, beverages, condiments and dairy were the most commonly reported triggers (Table 2). No considerable differences were observed in the distribution of STAI, BDI-PC or EDE-Q scores based on the number or type of suspected dietary triggers patients reported.

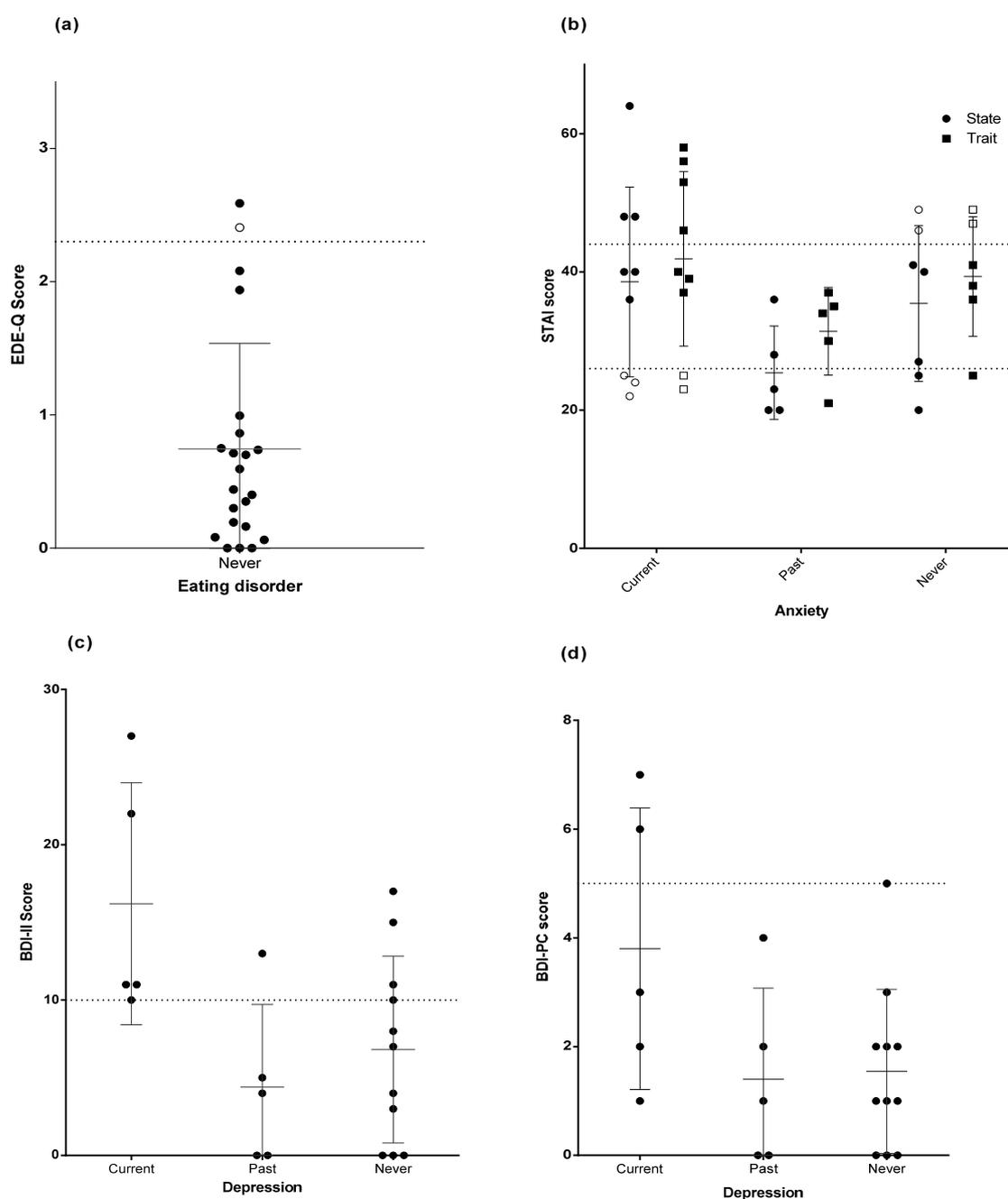


Figure 1 Self-reported psychological status and psychological questionnaire scores (Mean \pm SD). (a) Self-reported eating disorder status compared to EDE-Q score. Unfilled data point shows one patient who met criteria for high risk of an eating disorder. Y-axis line at 2.3 shows score cut-off contributing to criteria for high risk of an eating disorder. (b) Self-reported anxiety status compared to STAI scores (minimum score = 20). Y-axis lines at 26 and 44 show cut-offs for low and high likelihood of high anxiety, respectively. Unfilled data points show STAI scores disparate to self-reported anxiety status. (c) Self-reported depression status compared to BDI-II score. Y-axis line at 10 shows cut-off for low likelihood of clinical depression. (d) Self-reported depression status compared to BDI-PC score. Y-axis line at 5 shows cut-off for high likelihood of clinical depression.

No patient answered "current" or "past" to having an eating disorder (Figure 1a). One patient met the EDE-Q score criteria for a high risk of having an eating disorder.

EDE-Q questions for which this patient, and two 2013 study patients who also met the EDE-Q score criteria, scored highest were related to "feeling fat" and limiting, restricting and excluding foods to influence their weight. Patients who did not report their eating disorder status (n = 2) had unremarkable EDE-Q scores.

9/22 patients answered "current" to having anxiety (Figure 1b). 5/12 of the STAI scores below the cut-off for a low likelihood of high anxiety were from patients who answered "current". STAI statements for which these patients scored highest were "I am not relaxed", "I feel ... tense, nervous, jittery, restless" and "I do not feel... steady, rested". 4/11 of the STAI scores exceeding the cut-off for a high likelihood of high anxiety were from patients who answered "never". STAI statements for which these patients scored highest were "I am not content", "I lack self-confidence" and "I do not feel... at ease, satisfied, pleasant".

5/22 patients answered "current" to having depression (Figure 1c, 1d). Both patients who scored above the BDI-PC cut-off answered "current". All 11 patients who scored below the BDI-II cut-off answered "past" or "never".

Discussion

This study adds to the information available on depression, anxiety and eating disorder symptoms in adults prior to RPAH Elimination Diet prescription at the RPAH Allergy Unit.

In agreement with the research to date,⁵ the findings from this study suggest the distribution of depression, anxiety and eating disorder symptoms in adults prior to being prescribed the RPAH Elimination Diet are comparable to community norms.^{8,9,12,14} The distribution of psychological symptoms in the study sample contrasts with patients prescribed other restrictive diets such as a gluten-free diet for Coeliac Disease, where patients can have a higher prevalence of psychological symptoms than the general population.¹⁸

RPAH Elimination Diet prescription is typically based on how significantly patients' symptoms affect their day-to-day life, what dietary components they suspect are triggering their symptoms, and their ability to cope with dietary restriction.³

Psychological symptoms may not diminish patients' intention or confidence in adhering to restrictive diets.⁴ Consequently, patients' true capacity for adherence as mediated by psychological symptoms may be difficult to assess, which would result in a lack of association between psychological symptoms and diet prescription as seen in this study. This finding is supported by the lack of association found between psychological symptoms and suspected dietary triggers or presenting symptoms, agreeing with earlier research which reported no association based on symptom type.⁵ It should be noted however that the lack of association between psychological symptoms and presenting symptoms may have occurred if symptom type and number were not strongly indicative of the degree to which patients' symptoms adversely affected their lives. In other populations, for example, psychological symptoms are associated with greater symptom severity.¹⁸ Independent of the relationship between psychological and presenting symptoms, prescribing a more restrictive level of the RPAH Elimination Diet to a patient with depression, anxiety or eating disorder

symptoms could potentially compromise adherence to the extent that the benefits of the restrictive prescription are lost. This reinforces the importance of applying an effective screening tool to identify such patients and develop and implement measures to improve adherence accordingly.

The screening ability of the R-AF appeared to vary depending on the psychological symptom of interest. Self-reported anxiety status and STAI score were often discordant. Patients who reported current anxiety but had very low STAI scores scored highest on STAI statements relating to acute, low-level stress and nervousness, which may be due to patients' misinterpretation of the RPAH Allergy Unit Assessment Form question. For patients who reported never having anxiety and had very high STAI scores, STAI responses were highest for statements referring to depressive symptoms such as discontent and low-confidence. There is evidence to indicate the STAI can mismeasure depression symptoms as anxiety.¹⁹ This suggests that while these patients may indeed have had anxiety, it is also possible that their self-reported psychological status was a more accurate indicator of their true psychological status than questionnaire scores.

Patients' self-reported depression status and BDI-scores proved more agreeable, as no patients demonstrated significant discordance between the two measurements. This supports previous research that indicates simply asking if patients have depression may be more effective than using multi-question screening tools.²⁰

No patient reported a current or past eating disorder, limiting the ability to assess the validity of the R-AF. One patient who reported 'never' was identified as 'high risk', scoring highest on questions relating to dietary restrictions and attitudes focused on

losing weight. This score pattern was also observed in the 2013 'high risk' patients, potentially demonstrating a phenomenon that has been described previously where non-disordered weight loss attempts inflate EDE-Q scores.²¹ Patient denial, however, cannot be disregarded as a potential factor here.

Care should be taken when interpreting the findings of this study as several limitations were present. Firstly, the small sample size may be an unrepresentative sample, and reduced the probability of observing any differences between groups. Secondly, the sampling method may have resulted in several biases. Voluntary participation likely favoured patients interested in this study and those with adequate literacy and numeracy skills to comfortably complete the four-day WFR and questionnaires. The higher proportion of female patients in the study group compared to non-study patients is potentially an indicator of such sampling bias. Patients with psychological disorders were potentially underrepresented in the study group as they often struggle to complete tasks such as WFRs where self-monitoring is required.^{4,7} The small number of patients at high risk of anxiety, depression and eating disorders reduced the likelihood of observing differences based on these traits. As with all screening tools, the psychological questionnaires used in this study are only predictive and some measurement error is inevitable. Further, patients' answers to all questionnaires may have been influenced by factors such as social desirability bias, poor comprehension and the context of their initial appointment. For example, STAI scores can change significantly in response to high- or low-stress experiences in the hours before completing the questionnaire.¹⁸ Presenting symptom number and type may not correlate closely with the degree of quality-of-life impairment patients experience from their symptoms, and as such may not be associated with

psychological symptoms.¹⁸ In future studies, measures of symptom severity used in similar populations should be considered. Lastly, potential confounders such as socio-economic status and education level should be considered when assessing the significance of findings from this study.

Conclusion

This study indicates prior to being prescribed the RPAH Elimination Diet, adult patients present to the RPAH Allergy Unit with anxiety, depression and eating disorder symptoms in a similar distribution to the general population. These psychological symptoms, which can impair adherence, were not associated with the level of RPAH Elimination Diet prescribed, nor with presenting symptoms or suspected dietary triggers. The ability to screen patients at high risk of anxiety, depression and eating disorders is therefore essential; however, using R-AF questions for this purpose may not be effective for anxiety and eating disorders. Further research is needed to re-address the aims of this study in a larger sample in order to substantiate the trends in this study. Further, the evidence for an association between psychological factors and RPAH Elimination Diet adherence should be strengthened. This study provides a foundation for further investigation into the psychological symptoms of RPAH Allergy Unit patients and the impact these symptoms have on RPAH Elimination Diet prescription and adherence, which will allow the development and implementation of effective strategies to improve adherence.

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Conflicts of interest

No relevant disclosures.

Authorship

Natalya Lukomskyj was responsible for recruitment, data collection, data analysis and writing the manuscript. Amanda Neubauer and Kristy-Lee Raso contributed to recruitment, data collection and data entry. Dr Anne Swain, Brooke McKinnon, Carling Chan, Kirsty Le Ray and Dr Robert Loblay were responsible for the design and supervision of this study.

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