MOUNTAIN TRAINING

THE AWARDING BODY NETWORK

Developing excellence in outdoor provision:

Enhancing training pathways for outdoor qualifications

THE MOUNTAIN LEADER QUALIFICATION

Cronfa Gymdeithasol Ewrop
European Social Fund

PRIFYSGOL BANGOR UNIVERSITY

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Foreword

This is an unprecedented piece of research for Mountain Training United Kingdom and Ireland and I am delighted to introduce this report. The level of detail and length of this project is unique within our organisations and we are very pleased with the results.

Much of our focus in recent years has been to ensure that each of our qualifications matches the needs of our stakeholders and the many environments in which we work, whereas with this research we have been able to focus on the long standing process of training and assessment; the delivery system. Bangor University were given a fairly open brief to review our delivery system and it has been encouraging to learn that while it's not broken, there is more that we can do to support many of these people to gain our qualifications.

We are extremely grateful to all three researchers and hope that we will be in a position to conduct further research in the future. This report has provided us with much to think about and develop in the coming months and years, which we will do alongside stakeholders and providers to enable more people to become Mountain Leaders. We will also endeavour to use our learning to help other groups of candidates make the very most of their experiences in the mountains, crags and walls of the UK and Ireland.

John Cousins
Mountain Training United Kingdom
and Ireland Chief Executive Officer

Preface

This report is the product of a larger collaborative project between Mountain Training United Kingdom and Ireland and Bangor University. The primary objective of the project was to examine Mountain Training's qualification pathway (which has remained broadly unchanged since its creation in 1964) and identify possible enhancements to it in order that Mountain Training can help more of their candidates to progress from registering for a qualification to successfully completing it.

In 2018 there were 3,228 qualifications awarded to candidates, which suggests that this pathway is successful to some degree, as each year a large number of candidates are making it from registration to qualification. However, there is a drop-off in the number of candidates at each step in the pathway for all qualifications (i.e. registration to training, training to assessment, and passing an assessment; see Figure 1).

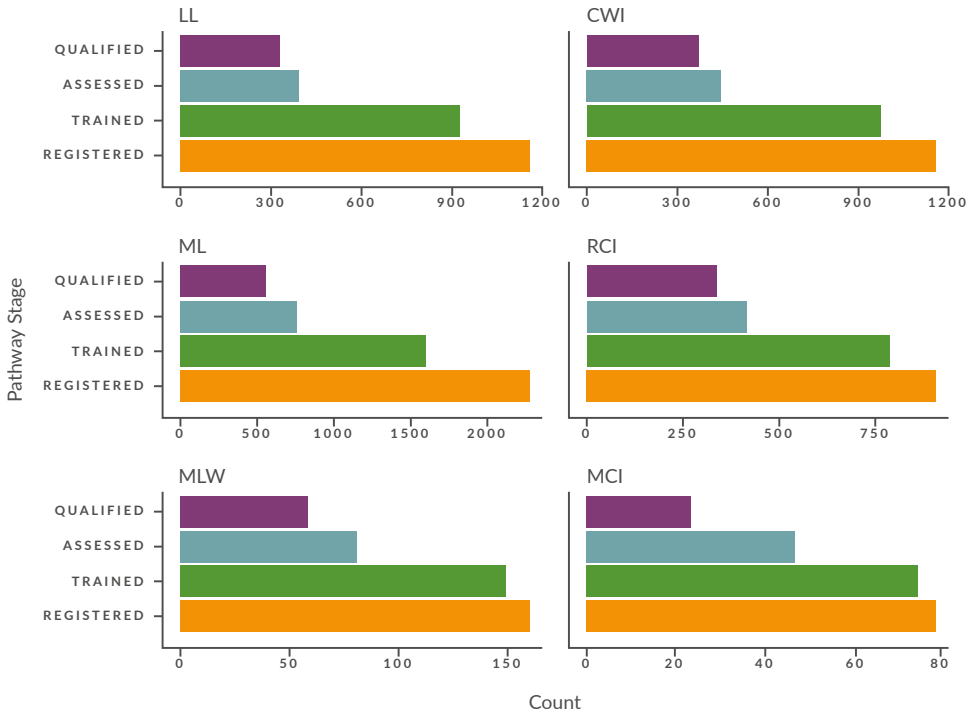

Figure 1: Average number of candidates at each pathway stage 2009-2018. LL = Lowland Leader, CWI = Climbing Wall Instructor, ML = Mountain Leader - Summer, RCI = Rock Climbing Instructor, MLW = Mountain Leader - Winter, MCI = Mountaineering and Climbing Instructor.

It is unlikely that there is a single factor that would be a "silver bullet" in answering the question, "why do candidates not complete Mountain Training qualifications?" Instead there are likely a myriad of factors which influence completion at various stages of the Mountain Training qualification pathway. Some of these factors will be generic to all qualifications, whilst some may be specific to individual qualifications/groups of candidates.

This report focuses on the Mountain Leader qualification for four main reasons: (a) it is the largest qualification as measured by number of candidates; (b) it has one of the largest drop-offs in candidates progressing from training to assessment, the drop-off at this point is of particular interest as candidates have engaged with the Mountain Training delivery system; (c) it is the highest entry level qualification; and (d) it is the oldest qualification and has had few major changes to it recently.

This report is structured in such a way that it can be read on a number of levels. At the first level, an executive summary is provided that presents a short summary of the report, including a distilled set of results. In addition to this, at the start of each section of results and discussion, we present "key messages" from the research that we feel are important for every reader to understand. The full report will provide readers with a deeper understanding of the findings as well as the methods used to reach them.

Executive Summary

INTRODUCTION

The pathway to assessment is similar for all Mountain Training qualifications and has remained broadly unchanged since its inception. There are greater numbers of candidates being trained than are qualifying, for some candidates this is because they are trained but are not assessed and for others this is because they are assessed but do not pass.

This part of the project aims to better understand the factors that influence the completion or non-completion of Mountain Training's largest qualification, the Mountain Leader. The findings presented in this report are from a three-year, multi-method, multi-study collaborative project between Mountain Training United Kingdom and Ireland and Bangor University.

There are differences in the proportion of female and male candidates who have been assessed at a given point in time after their training course, in both cases, 50% of those who will ever go on to be assessed, have been within 18 months of their training course. There is no statistically significant difference in the pass rates for female and male candidates between 2013-2018.

In a preliminary study, a total of 37 hours of qualitative interviews were conducted with four Mountain Training Officers and three experienced Mountain Leader course directors. The results of this interview study informed the development of a survey tool which was used to collect quantitative data from 1,536 candidates who had attended their first Mountain Leader training course between 2008 and 2018. These quantitative data were then analysed using both standard statistical procedures and state of the art pattern recognition procedures to identify **the most important variables for discriminating: *(a) candidates who were assessed within 18 months of their training course from those who were not* and *(b) candidates who passed their first assessment from those who did not.***

MAIN RESULTS

We were able to discriminate candidates who were assessed within 18 months of their training course from those who were not with up to 96% accuracy (i.e. if we took 100 candidates, we successfully classified 96 of them as having been assessed or not within 18 months of their training course and four of them would be misclassified) and those who passed their first assessment from those who did not with up to 86% accuracy. Where additional data were available, we found support for these results, thus strengthening our confidence in them.

Five key findings emanated from the pattern recognition analyses:

1. For both female and male candidates, how they felt becoming a Mountain Leader would fit into the rest of their life was important in discriminating those who were assessed within 18 months of their training course from those who were not.
2. Coaching behaviours of training course staff, *especially in relation to using goal setting to set clear and specific goals for preparing effectively for an assessment*, are important for candidates both getting to *and* passing an assessment.
3. For both female and male candidates, it is important that they are confident in their abilities to perform a series of tasks related to passing a Mountain Leader assessment and that gaining relevant experience will increase their levels of confidence to do so.
4. Candidates must have *sufficient relevant experience* in order to pass an assessment.
5. Taking the previous points together, it becomes clear that **what candidates do after their training course is extremely important in determining if they will successfully complete the Mountain Leader qualification or not. It is not just about gaining more experience relative to the Mountain Leader qualification in general, but it is about gaining experience specific to preparing for an assessment.**

These results should be heartening and helpful to Mountain Training as they point to a specific area of the pathway where Mountain Training can focus its efforts.

LIMITATIONS

A number of limitations can be identified with this study, most importantly sampling bias and issues relating to recall accuracy in the quantitative data collected from candidates. However, the results of the retrospective analyses have been supported by the qualitative results, and in some instances prospective analyses of quantitative data collected from candidates. Thus, readers can be confident in the accuracy of the findings presented here.

RECOMMENDATIONS

The findings presented in this report highlight the importance of the candidates making good use of their consolidation period post-training. The most impactful implications of this work will be realised through the discussion of the findings by key stakeholders. Therefore, it is recommended that Mountain Training establishes a working group to identify potential additions to the pathway which would help candidates make the most of their consolidation period.

We would also recommend that some of the data collected for this project are analysed further (in a prospective fashion) and that data are collected at future time points which would reduce the impact of sampling bias and validate the findings presented.

1 - General introduction

Mountain Training is responsible for training instructors for walking, climbing, and mountaineering in the UK and Ireland. Its qualifications all follow a similar pathway to qualification, which was originally created in 1964 for the Mountain Leadership Certificate (what is now the Mountain Leader qualification) and has not changed much since then. Candidates must first gain some *prerequisite experience and register for the qualification*, then they *complete a training course*, following that they are required to gain *further experience to consolidate skills*, and finally they need to *successfully complete an assessment course*, following which they will be awarded the relevant qualification.

As seen in Figure 1 there is a large difference in the number of candidates who are trained and assessed each year. To examine this difference for the Mountain Leader qualification in more detail we carried out a *survival analysis*, where rather than looking at summary statistics averaged over a number of years, we look at the probability of an individual candidate having been assessed over time following their training course. As can be seen in Figure 2 at any given point in time, **fewer female candidates get to an assessment than male candidates.** The percentage likelihood of a candidate having been assessed five years following their training course is ~32% and ~40% respectively for female and male candidates, after this point the rate of candidates being assessed decreases for both sexes. Half of candidates who did reach assessment did that within 18 months of their training courses, but it is not unusual to take longer, and some candidates do go on to be assessed over five years after their training course.

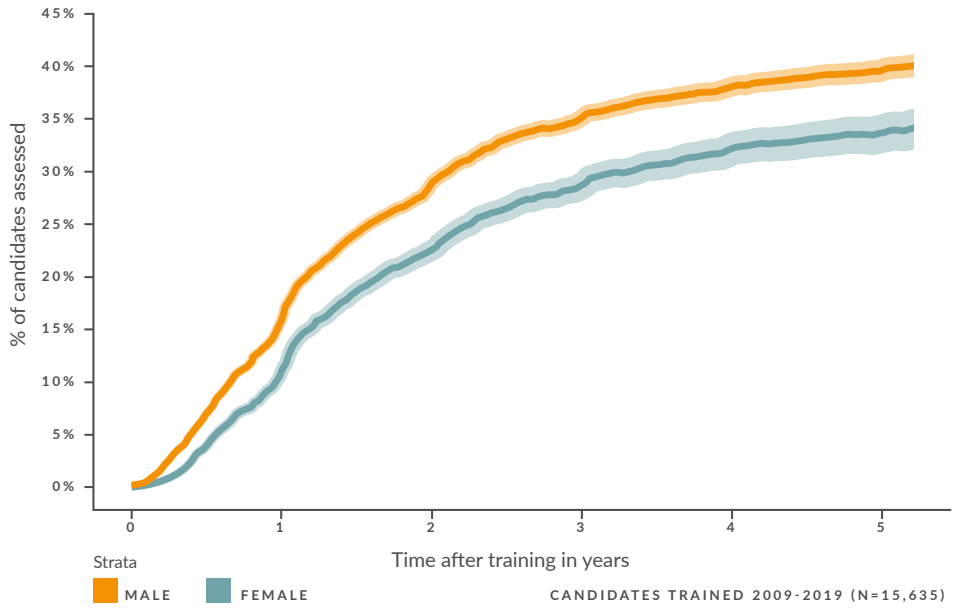

Figure 2: Survival rates for female and male candidates post-training.

We also examined the pass rates for the Mountain Leader qualification. **The pass rate is increasing over time and there have been changes to sex differences in the pass rates over the last 10 years** (Figure 3). When looking at pass rates for the last 10 years, women were less likely to pass their first assessment, but the pass rate was increasing faster for them than it was for men. However, when looking at data from the last five years, neither the effect of sex on the pass rate or rate of change of the pass rate are statistically significant.

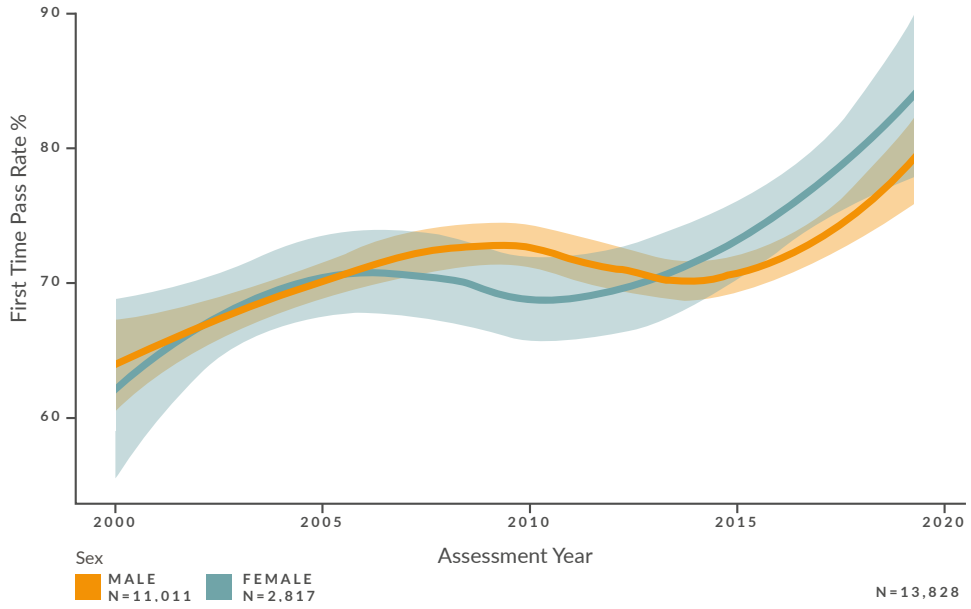

Figure 3: Pass rates for female and male candidates assessed since 2000.

There is a wealth of knowledge dispersed throughout the Mountain Training network, relevant to understanding why some candidates do not complete qualifications and others do. Whilst there is some quantitative data available on Mountain Training's Candidate Management System (CMS) these data are mostly limited to demographics and candidates' training and digital logbook (DLOG) records. Furthermore, much of the qualitative knowledge is somewhat compartmentalised and anecdotal, making it hard to use in a meaningful way.

By synthesising the qualitative information and then collecting relevant quantitative data this project aims to:

1. Identify a set of important variables for discriminating each of the following:
   (a) Female candidates who are assessed 18 months after their training from those who are not.
   (b) Male candidates who are assessed 18 months after their training from those who are not.
   (c) Candidates who pass their first assessment from those who do not.
2. Allow Mountain Training to make *evidence-based change*, if they wish to do so.

To improve the readability of the report, in each section of the results and discussion, we present the key messages first in the form of bullet points, before providing the evidence to support these key messages. A glossary of terms can also be found in *Appendix A*; this will be used to explain some of the more technical language used in the report, specifically that relating to the variables included in the analyses. Each term that appears in this glossary will be italicised in its first usage in the body of the report (not in a table or figure).

2 - Methods and preliminary studies

2.1 PRELIMINARY STUDIES

2.1.1 What do we think is important? - Study 1

2.1.1.1 Introduction

To identify potentially important factors for the completion of the Mountain Leader qualification, we reviewed relevant literature and conducted a qualitative study with Mountain Training Officers and experienced course staff (*n* = 7) who had worked on a total of 1,060 Mountain Leader courses between them.

2.1.1.2 Methods

We carried out in-depth qualitative interviews with four Mountain Training Officers and three experienced course directors (two females and five males). On average, these participants had worked on approximately 60 Mountain Leader training courses over 19 years and approximately 92 Mountain Leader assessment courses over 17 years.

The interviews were semi-structured, using an interview guide to ensure that we covered topics of interest with each participant, but allowing the interview to cover other areas of interest as and when they arose. The interview guide was organised into the following sections: (a) candidate background, (b) candidate career history, (c) personal characteristics of candidates, (d) candidate experience and experience of training, and (e) support that candidates may or may not receive.

The interviews lasted approximately five and a half hours and were conducted in two to four sessions with each participant. This process yielded transcripts of almost 45,000 words per participant, which were coded thematically using an abductive approach. The research team all have over 10 years of relevant outdoor experience, which meant that good rapports could be established with interview participants and that the subtleties of the phenomena of interest could be fully understood.

2.1.1.3 Results

A brief summary of results for this study can be seen in Table 1. It is beyond the scope of this report to discuss these results in detail; however, it is important to note that different factors were reported as important by interviewees for either getting to assessment or passing an assessment. We also developed a list of hypotheses and potentially important factors for which we needed to collect quantitative data from candidates to evaluate.

Getting to assessment	Passing
- Self-efficacy	- Ability
- Participatory and regulatory motives	- Performing under pressure
- Understanding of the qualification	- Staff behaviour
- Ability to gain experience	- Quality, quantity, and variety of experience

2.1.2 Survey tool development - Study 2

2.1.2.1 Introduction

The aim of Study 2 was to develop a survey tool, which could be used to collect quantitative data from candidates for over 50 variables (identified as potentially important for the completion of the Mountain Leader qualification in *Study 1*) that data were not available for on the CMS. These variables covered four main areas: personality, motivation, confidence, and experience of training.

In October 2018 the research team presented the findings of *Study 1* to the Mountain Training UK council and ran a workshop, with 30 participants, to check that there was nothing important missing from the list of variables and to garner feedback about the face validity of some items. Following completion of the survey development, the data were collected (see below). We then used state of the art pattern recognition techniques to identify the variables that consistently discriminated candidates who (a) did and did not get to assessment within 18 months of their training course and (b) did and did not pass their first assessment.

2.1.2.2 Methods

The first step in creating the survey tool was to identify variables of interest and then to identify or create a suitable short measure for each of them. We employed a variety of techniques to ensure maximum validity for each of the measures, including using Bayesian Structural Equation Modelling (Muthén & Asparouhov, 2012) and reference to secondary data where possible. Once this process was complete, we were left with a pool of 194 items. If we had created a single survey with all of these items in it would have taken over 40 minutes to complete, which would have increased drop-out from the survey and those that did complete the survey in full would be less representative of the population than those who would complete a shorter survey. Instead, we created four surveys, each with approximately 120 items where each possible pair of variables was included in at least one of the four surveys and each variable was included in at least two of the four surveys.

2.1.2.2.1 Participants

We invited 3,794 candidates who had attended a Mountain Leader training course between 2008 and 2016 to participate in the study, and each candidate was randomly allocated to one of the four surveys. We received 1,056 usable responses (27.83% response rate)[1] from 256 female candidates (*M*age = 41.46 ±11.32 years) and 800 male candidates (*M*age = 45.16 ±12 years). These candidates had been trained by 112 different providers and assessed by 85 different providers.

2.1.2.2.2 Analytical procedure

To analyse the data we employed state of the art pattern recognition analyses, originally used in bioinformatics to classify objects according to features that they possess (Duda, Hart, & Stork, 2000). The aim of these analyses was to identify, from a potentially large number of features, a subset of features that best discriminate objects of one class from another. In this project, features are the variables we have collected data on, objects are the candidates that these data have been collected from, and the classes are the categories of the outcome variable (e.g. being assessed within 18 months of training or not). The interested reader will find more detail on the analytical procedure in *Appendix B*.

[1] *Similar surveys might normally expect ~10-20% response rates.*

2.1.2.3 *Results*

The results of the pattern recognition analyses produced eight feature subsets, which had classification rates from 50 to 87%. At this stage we did not interpret the remaining features, but we retained them to create the final survey tool. *It is important to note that just because a feature was not included in a final feature subset does not mean that it was not important for either getting to assessment or passing, as some variables will be important commonalities between the groups that we are trying to discriminate.* This reductive process eliminated approximately 80 items from the full set (e.g. education level, income level, sources of support).

2.2 PARTICIPANTS AND DATA COLLECTION

We contacted all candidates who attended their first Mountain Leader training course in 2017 or 2018, inviting them to participate in the study. One thousand and thirty candidates started the survey and 480 completed the survey (16.74% response rate). Useable responses were from 166 female candidates (*M*age = 37.06 ±10.95 years) and 314 male candidates (*M*age = 41.9 ±12.28 years). These candidates had been trained by 70 different providers and assessed by 52 different providers.

Candidates completed a survey that contained questions about the variables selected in the *preliminary work*. At this point, it is important to explain the term *pre-assessment*. When starting the survey, candidates were asked, "Have you attended a Mountain Leader assessment course?" If they answered "yes", then the wording for these pre-assessment variables asked them to think about how they felt or what they experienced **immediately prior to their first assessment course.** If they answered "no," the questions asked them how they felt **now, or what they had experienced recently.**

Each of the main analyses used a different subset of candidates who had responded to the survey. Details of the candidates included in each analysis are presented below.

2.2.1 *Getting to assessment within 18 months of training - Male candidates*

There were 65 responses from male candidates who completed the survey more than 18 months after their training course (i.e. retrospectively), 33 of whom had been assessed within 18 months of their training course and 32 who not been assessed at the time of completing the survey[2]. Therefore, we were able to create a set of *learning data* (*n* = 55), which we could use to select variables and a set of *test data* (*n* = 10, with an equal split of candidates who had and had not been assessed). In addition to this, 59 male candidates completed the survey more than 12 months after their training but less than 18 months after their training (i.e. prospectively). Using the model developed with the learning data, we made predictions for each of these candidates which we have been able to test as all of them are now more than 18 months post training.

[2]*Candidates who had not been assessed within 18 months of their training course but had been assessed prior to completing the survey were excluded from the analysis as the wording of the questions shown to them meant they would not be comparable to the other candidates.*

2.2.2 Getting to assessment within 18 months of training - Female candidates

The data used for this analysis were collected from 27 candidates who had been assessed 18 months after their training (*M*age = 35.98 ± 10.93 years) and 27 who had not (*M*age = 34.29 ± 10.31 years). We received fewer responses from female candidates, therefore we combined the retrospective and prospective data as neither group would have been large enough on its own. In each group there were 10 candidates who completed the survey retrospectively (i.e. more than 18 months post-training) and 17 who completed the survey prospectively (i.e. 12-18 months post-training).

2.2.3 Passing first time

The data used for this analysis were collected from 46 candidates, 35 of whom had been assessed prior to completing the survey and 11 of whom had not been assessed before completing the survey. As with the data in *female candidates getting to assessment*, we combined the retrospective and prospective data to increase the sample size[3]. Twenty three of the 46 candidates passed their assessment first time. Of the 23 who did not pass, 6 completed the survey prospectively. Two of the 23 candidates who did not pass withdrew from their first assessment, none failed, and the remainder were deferred. Seven of those who were deferred only needed to log additional days.

2.3 ANALYTICAL PROCEDURE

We used the same pattern recognition procedure as in the pilot work, to identify two feature subsets. The first was to discriminate candidates who were assessed within 18 months of their training from those who were trained over 18 months ago **and** had not been assessed when completing the survey. This was done to ensure the pre-assessment variables were comparable but does mean that candidates who were assessed more than 18 months after their training course were excluded from the analyses. Eighteen months was chosen as: a) half of all candidates who are assessed, have been within 18 months, b) it reduced the likelihood of recall issues, and c) it also fitted the timescale of this project. The second feature subset we aimed to identify was that which best discriminated candidates who did pass their first assessment from those who did not (irrespective of how long it took them to get to assessment).

[3] *We have run the analyses on just the retrospective data, which allowed us to include some variables about candidates' experiences of assessment, but none of these variables were selected in the best discriminatory subsets, nor were the classification rates significantly higher.*

3 - Results

3.1 GETTING TO ASSESSMENT WITHIN 18 MONTHS OF TRAINING - STUDY 3

3.1.1 Key messages

- For both female and male candidates, we were able to discriminate candidates who are assessed within 18 months of their training from those who are not with *good* accuracy.
- Whilst some of the discriminatory variables are specific to female or male candidates, others are common to both:
  - Progress towards becoming a Mountain Leader, both absolutely and relative to other life goals.
  - The relative importance of becoming a Mountain Leader compared to other life goals
  - Perceived progress in effectively preparing for a Mountain Leader assessment.
- It is important for candidates getting to assessment within 18 months of their training course and passing an assessment, that course staff display good coaching behaviours, particularly goal setting, thus facilitating candidates' effective preparation for assessment following training.
- Relevant experience (i.e. QMDs) is important, particularly for female candidates, to develop candidates' confidence to perform Mountain Leader related tasks (e.g. looking after themselves and others in steep ground and crossing rivers)

3.1.2 Overview

We present two feature subsets, one for female candidates (Figure 5) and one for male candidates (Figure 4), which discriminate candidates who have been assessed 18 months after their training course from those who have not. Both of these models discriminate candidates with *very good* accuracy on the learning data (87.04-96.30% and 89.09-92.73% respectively). Neither of the models included in this section of the report contain DLOG data[4].

For all of the feature subsets presented in this document, it is important to note that it is the *combination* of features that discriminates the groups with the particular level of accuracy and not any single feature. Any visualisation is only a crude representation of the relationship between these variables and reflects an attempt to aid interpretation of the findings for the reader. Within the results there may be a series of complex interactions between the discriminating variables, which are impossible to represent graphically in two (or even three) dimensions.

3.1.3 Male candidates

3.1.3.1 Key messages

- It is important that becoming a Mountain Leader fits into male candidates' lives as it:
  - Allows them to make progress and prepare effectively for an assessment.
  - Reduces the expected time to assessment both pre- and post-training.
- Greater understanding of the qualification pre-training and a stronger intention to be assessed post-training are both important for getting to assessment.

The following sections will first present the model developed using the retrospective data and then the results of predictions made for candidates who completed the survey more than 12 months but less than 18 months after their training course.

[4]*We have performed various analyses on subsets of the data; none of the subsets that included DLOG data classified candidates with a significantly higher percentage accuracy than the subsets presented in this report. These particular findings suggest that any variance explained by the DLOG data is shared by other variables that are included in the models presented here. On its own the DLOG data discriminated both female and male candidates across the four classifiers with modest accuracy (54.81-75.93% and 49.09-76.36% respectively).*

3.1.3.2 Results

This analysis is based on a learning data set collected from 28 candidates who had been assessed 18 months after their training course (*M*age = 41.61 ± 12.79 years) and 27 who had not been (*M*age = 37.93 ± 12.22 years).

A subset of 16 features was selected as the best combination of discriminatory features. This subset classified the male candidates having been assessed within 18 months of their training course or not having passed their first assessment with *very good* accuracy (NB = 90.91%, SMO = 92.72%, IBk = 90.91%, J48 = 89.09%). We were also able to test this feature subset on 10 previously "unseen" candidates, again, we were able to discriminate candidates with *very good* accuracy (NB = 90%, SMO = 80%, IBk = 80%, J48 = 90%). This "test" increases our confidence in the discriminant function of this feature subset as these candidates were not included in identifying the most important discriminatory variables. Stereotypical profiles from male candidates who have and have not been assessed are visualised in Figure 4 and described in Table 2.

Table 2: Discriminatory features for male candidates getting to assessment within 18 months of their training course.

Male candidates who had been assessed within 18 months of their training were more likely than those who had not been to:
Have felt more resilient.
Have been more confident in their understanding of the qualification before their training course.
Have had a stronger intention to be assessed by the end of their training course.
Have expected that it would take less time to get to assessment from their training both at the start and the end of their training course.
Have been trained closer to the middle of the calendar year (i.e. the summer).
Have felt that in the last six months of their consolidation: – They had made progress towards becoming a Mountain Leader. – That becoming a Mountain Leader was important to them. – They had made more progress towards becoming a Mountain Leader than they had towards two other stated goals they were pursuing in their life. – That becoming a Mountain Leader was more important than attaining those other two goals. – They had more resources and skills available to them to successfully become a Mountain Leader than they did to attain the other two goals. – They had done more to prepare effectively for a Mountain Leader assessment course – That they had less esteem support available to them.
Have experienced less social change since their training course (e.g. children moving out from home, gaining or losing an immediate family member (adoption, birth, death), marriage/divorce, moving to a new home, becoming a carer for a relative/friend).
Have felt that they had enough available time to become a Mountain Leader.
Have had a less negative discrepancy between their pre-assessment self-efficacy and ideal self-efficacy to "look after myself and others in steep ground/crossing a river" (i.e. they were closer to reaching or surpassing the level of confidence that they would have in an ideal world).

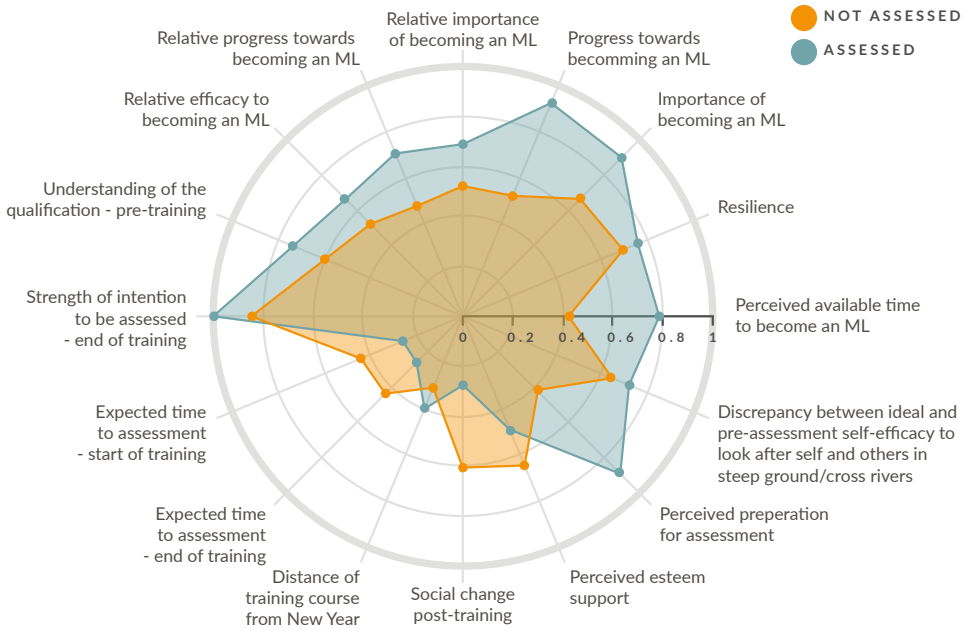

Figure 4: The 16 discriminatory features between male candidates who had and had not been assessed 18 months post-training. Note: Data points reflect the normalised mean values for each group (i.e. 0 represents the lowest value in the group and 1 represents the highest value; this transformation allows all variables to be displayed on the same scale).

3.1.3.3 *Predictions*

The predictions we made using the prospective data were *modest* in accuracy (NB = 72.88%, SMO = 74.58%, IBk = 72.88%, J48 = 71.19%). This is lower than the accuracy of both the training and test models, however these models *excluded candidates who had been assessed more than 18 months* after their training course. If we exclude candidates who had been assessed more than 18 months after their training course from the evaluation of the predictions, we would class the accuracy of these predictions as *good* (NB = 83.33%, SMO = 86.05%, IBk = 83.72%, J48 = 80.49%). As such, these data indicate the feature subsets have good predictive validity, yet candidates who are assessed more than 18 months after their training course may be misclassified. However, given that the aim of this project is to identify the factors that influence completion these errors should not be too concerning.

3.1.4 *Female candidates*

3.1.4.1 *Key messages*

- In addition to the key messages above, specifically for female candidates to get to an assessment within 18 months of their training course, it is important that they:
  - Are able to prepare effectively for a Mountain Leader assessment, which will be most likely to occur when it is directed by goal setting facilitated by training course staff.
  - Feel confident in their abilities to successfully perform tasks related to hazards and emergency procedures on a Mountain Leader assessment.

3.1.4.2 *Results*

A subset of 11 features was selected as the best combination of discriminatory features. This subset classified the female candidates having been assessed within 18 months of their training course or not having passed their first assessment with *very good* accuracy (NB = 87.04%, SMO = 96.30%, IBk = 92.59%, J48 = 87.04%). Stereotypical profiles from female candidates who have and have not been assessed are visualised in Figure 5 and described in Table 3.

Table 3: Discriminatory features for female candidates getting to assessment within 18 months of their training course.

Female candidates who had been assessed within 18 months of their training were more likely than those who had not been to:
Have felt that their training staff helped them with goal setting on their training course.
Have felt more confident in their ability to perform the following tasks pre-assessment: – Look after themselves and others in steep ground/crossing a river. – Provide immediate medical care in the mountains. – Respond appropriately to an emergency (e.g. a broken leg).
Have felt that in the last six months of their consolidation: – They had made progress towards becoming a Mountain Leader. – They had done more to prepare effectively for a Mountain Leader assessment course. – They had made more progress towards becoming a Mountain Leader than they had towards two other stated goals they were pursuing in their life. – That becoming a Mountain Leader was more important than attaining those other two goals.
Have experienced less professional change since their training course (e.g. changing job, increased/decreased income, retirement, change in working hours but not changes to family).
Have felt that in an ideal world they would have a higher number of QMDs before being assessed.
Have had an extrinsic motive as their second goal for registering for the Mountain Leader qualification.

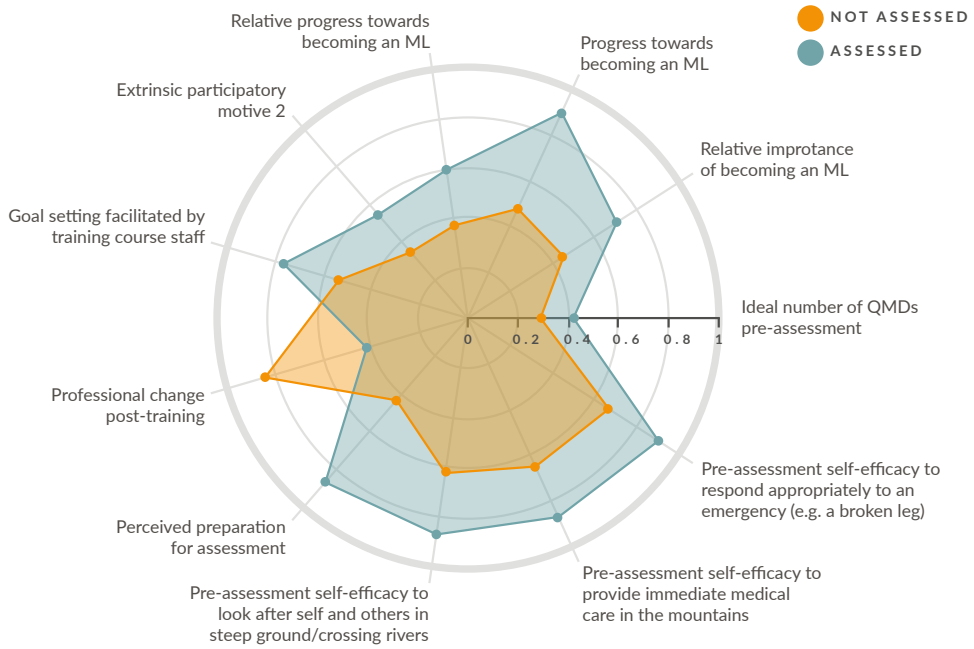

Figure 5: The 11 discriminatory features between female candidates who had and had not been assessed 18 months post-training. Note: Data points reflect the normalised mean values for each group (i.e. 0 represents the lowest value in the group and 1 represents the highest value; this transformation allows all variables to be displayed on the same scale).

3.2.1 *Key messages*

- A subset of 11 variables, all of which can be collected before assessment, can be used to discriminate candidates who pass their first assessment from those who do not with good accuracy.
- For candidates to pass their first assessment, it is important that they:
  - Gain relevant experience prior to their assessment.
  - Use clear and specific goals to maximise the effectiveness and efficiency of their preparation.
  - Are able to cope with the pressures of the assessment process, which will be influenced by both their relevant experience and social support.

3.2.2 *Results*

A subset of 11 features was selected as the best combination of discriminatory features. This subset classified the candidates having passed or not having passed their first assessment with *good* accuracy (NB = 71.74%, SMO = 86.96%, IBk = 82.61%, J48 = 69.57%). Stereotypical profiles for candidates who do and do not pass their first assessment are visualised in Figure 6 and described in Table 4.

Table 4: Discriminatory features for candidates passing their first assessment.

Candidates who passed their first assessment were more likely, than those who did not, to:
Have felt that they lived nearer to a mountainous region.
Be White-European.
Be more extraverted.
Have felt that their training staff provided them with structure on their training course.
Have felt that their training staff helped them set goals on their training course.
Have felt that they had more esteem support available to them prior to their assessment.
Have received more emotional support in the week prior to their assessment.
Have had more QMD logbook entries at assessment.
Have had fewer Quality Hill/Moorland Days at assessment.
Have had fewer types of weather logged for Quality Hill/Moorland Days at assessment.
Have attended a Mountain Skills course.

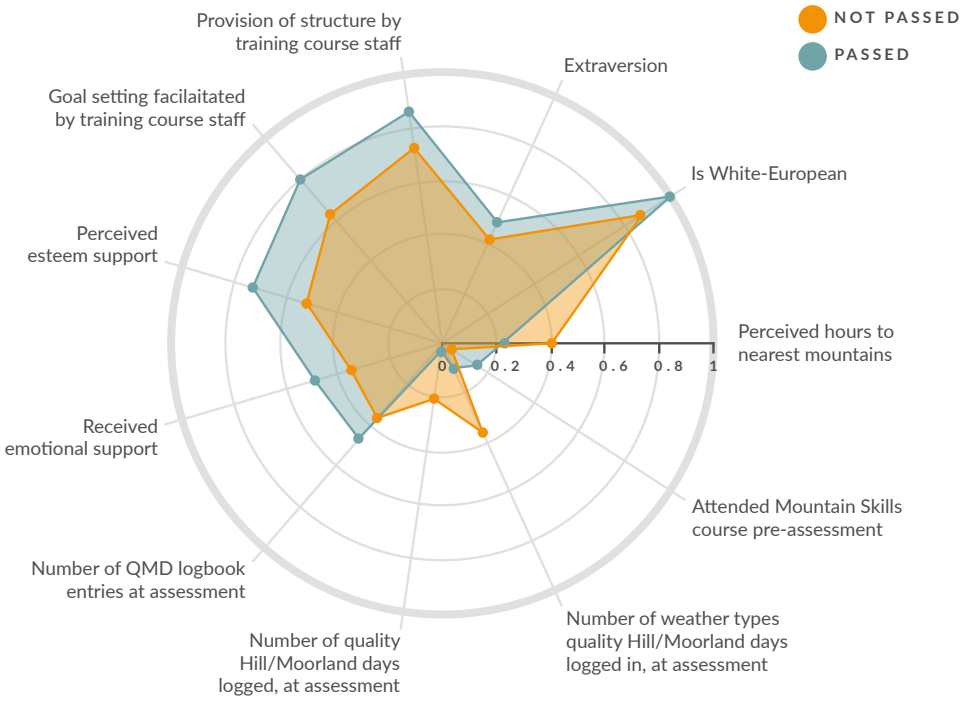

Figure 6: The 11 discriminatory features between candidates who passed their first assessment and those who did not. Note: Data points reflect the normalised mean values for each group (i.e. 0 represents the lowest value in the group and 1 represents the highest value; this transformation allows all variables to be displayed on the same scale).

3.3 SUPPLEMENTARY ANALYSES - STUDY 5

The key messages from this section are included to help understand the discriminatory feature subsets listed above, the relationships between some of the variables within them, and also to test some of the hypotheses generated from the qualitative study. However, for the sake of brevity and to not cloud the key messages of this report, the supporting details are presented in *Appendix C*.

3.3.1 Key messages

- Candidates who passed their first assessment felt that their training course staff displayed more coaching and need supportive behaviours than those who did not.
- There is a positive relationship between experience and confidence, this relationship is stronger for female candidates than it is for male candidates.
- Male candidates with little experience are more confident than female candidates with equivalent experience.
- **Most candidates intend to be assessed** at some point after their training course, however the stronger their intention and sooner they intend to be assessed, the more likely they are to be assessed.

4 - General discussion

4.1 KEY MESSAGES

- It is important that becoming a Mountain Leader fits into a candidate's life as this will influence their ability to gain relevant experience and prepare effectively for an assessment.
- Goal setting, facilitated by training course staff, is important for both getting to assessment and passing. It will be most effective when coupled with the *provision of structure* allowing candidates to set very specific goals, that are clearly aligned with the requirements of passing the assessment creating opportunities for *mastery experiences*.
- It is important that candidates feel confident in their skills, especially those relating to hazards and emergency procedures.
- The more experience a candidate gains, the more confident they will be.
- It is important that candidates have a strong intention of being assessed and do not expect that it will take them a long time.

4.2 OVERVIEW

The studies presented in this report aimed to identify important factors that discriminated candidates who (a) having been trained, went on to be assessed within 18 months of training from those who did not, and (b) having got to their first assessment, pass first time from those who did not. To achieve these aims we considered a wide range of potentially relevant variables. The results presented show that there is no one single factor that is important for discriminating candidates and in fact there are some important commonalities between groups, which are likely fundamental for the successful completion of the Mountain Leader qualification. Some of the discriminatory variables are common to both stages of completion, or to both female and male candidates getting to assessment.

4.3 MALE CANDIDATES - GETTING TO ASSESSMENT

The results presented in *Section 3.1.3* suggest that how becoming a Mountain Leader fits into male candidates' lives is important when considering the likelihood of them being assessed. If a candidate **feels that becoming a Mountain Leader is an important life goal, generally or relative to other life goals,** they may be more likely to commit time and resources towards it, thus may feel that they can prepare for an assessment in a shorter period of time, which for many, would include revisiting more technical areas of the syllabus like river crossings or practising skills they rarely use like emergency rope work. Candidates who felt that they had more **available time** to become a Mountain Leader, had done more to effectively prepare for a Mountain Leader assessment, had made more **progress towards becoming a Mountain Leader,** and were **more confident that they could become a Mountain Leader than to achieve other life goals** were more likely to have been assessed 18 months after their training course.

Some candidates are less certain in their **understanding of the purpose of the Mountain Leader qualification prior to their training course** and may be attending in order to find out more about the qualification, whereas those who are more certain of the purpose are more likely to be doing it in order to progress to an assessment. The **strength of candidates' intentions to be assessed at the end of their training course** being an important discriminatory variable is in line with the *Theory of Planned Behaviour* (Ajzen, 1991). The Theory of Planned Behaviour suggests that intentions are the strongest predictors of behaviour and that the strength of these intentions also predicts the behaviour (Armitage & Conner, 2001).

The strength of a candidate's intention to be assessed at the end of the training course may be more important than their intention at the start because the candidates who were less sure of the purpose of the Mountain Leader qualification would have had less information to base their intention on. This position is supported by the fact that the correlation between being assessed 18 months post-training and the intention to be assessed at the start of the

training course (*r* = . 16, 95% CI [– . 11, . 41]) is lower than the correlation between being assessed 18 months post-training and the intention to be assessed at the end of the training course (*r* = . 35, 95% CI [– . 10, . 57]). The results in Section 8.3.4 support this, including using prospective data and retrospective data from female candidates, which suggests the strength of intention is important for all candidates, despite not being one of the most important discriminatory variables for female candidates.

Candidates who **expect it to take them longer to get from training to assessment** are less likely to be assessed within a given period. Candidates may also expect it to take them longer as they either have less available time, live further from the mountains, or a combination of the two, making it more difficult to fit into their lives. If candidates who expect to take longer do take longer, then there will be more opportunities for things to get in the way of them pursuing that goal and becoming barriers to completion.

Further, experiencing **social change** after a training course may mean that candidates have more or less available time, or have changes in their priorities. The question used in the survey did not ask if candidates had more or less resources (e.g. available time) because of this change, however given that the more social change a candidate experienced, the less likely they were to be assessed within 18 months, it would be reasonable to assume that these social changes are more likely to leave candidates with less, rather than more, resources to become Mountain Leaders.

In our analyses we used the time of year that courses took place as a proxy measurement of weather and daylight hours. We would expect courses near the New Year to have worse weather and less daylight than those nearer to the middle of the year. Given that candidates who were trained closer to **the middle of the year (i.e. June/July)** were more likely to have been assessed 18 months after their training course, it is likely that better weather and more daylight on the training course provides candidates with a more positive experience and possibly a better learning environment. To investigate this further, weather data (held on CMS) and daylight hours data should be included in the feature selection stage of additional analyses of these data.

An extensive literature exists which supports the benefits of resilience in relation to various life outcomes (e.g. Seery & Quinton, 2016). Becoming a Mountain Leader is a difficult process which requires the investment of time, energy, and money and most candidates will have to deal with setbacks during this process. Candidates who are more **resilient** will be better able to overcome the adversity faced during the process (Smith et al., 2008) whether this relates to specific events such as bad weather on a training course, or more long-term issues such as changes in life circumstances that become barriers to becoming a Mountain Leader. It is also a central tenet of *Self-Efficacy Theory* that people with firmly established self-efficacy beliefs are more resilient (Bandura, 1997) as the stronger self-efficacy beliefs are, the easier they are to maintain following disconfirming events.

One would normally expect the availability of social support to be a positive influence on an outcome; however the results in this study suggest that having higher levels of ***perceived esteem support*** means that candidates are less likely to have been assessed 18 months after their training course. One explanation for this is that candidates who do not feel that they need esteem support answer this question in a different way to those who do (i.e. they don't perceive it as available), therefore those who feel they need it score more highly and with less variation in their responses. Another explanation is that esteem support may be reinforcing beliefs around unpreparedness for male candidates, with greater levels of esteem support acting to simply remind candidates that they are not ready for an assessment. Without further investigation both of these explanations remain somewhat speculative, although it is worth noting that findings consistent with the latter explanation, where psychological skills and strategies have paradoxical effects on performance, have been reported elsewhere in the literature (Roberts, Woodman, Hardy, Davis, & Wallace, 2013). Regardless, the results highlight that some support strategies might need to be utilised with caution.

Candidates who **feel less able to look after themselves and others than they would in an ideal world on steep ground and crossing rivers,** may feel that they are not ready to pass an assessment and therefore not attend one. For a number of candidates, these skills will be the most specialist mountaineering skills they possess and will have little reason, beyond passing a Mountain Leader assessment, to practise them. Unless these candidates have spent time deliberately preparing for an assessment, it is likely that they will feel less confident than they would like to at assessment, that they can successfully demonstrate these skills.

4.4 FEMALE CANDIDATES - GETTING TO ASSESSMENT

As with the results for male candidates, **how important becoming a Mountain Leader is to a candidate, relative to other life goals,** is an important discriminatory variable for female candidates. We would expect this variable to have the same implications as those already discussed for male candidates. Again, the more **progress that candidates have made towards becoming a Mountain Leader,** the more likely they are to feel that they have **prepared effectively for a Mountain Leader assessment** and in doing so, they will have gained experience that boosts their confidence in their abilities to perform tasks related to the assessment. It is likely that **professional change** will have similar effects for female candidates as social change does for male candidates.

Interestingly, changes to family (e.g. having a child) was included as an example of social change and not professional change. Many people suggest that female candidates do not progress to an assessment because they have a child, it would therefore be reasonable to expect social change to have been more important than professional change for female candidates. One explanation for this finding is that female candidates do not feel that having a child is a social change, rather they feel that it is a professional change as it may constitute a "change in working hours," which was given as an example of professional change. Whilst this finding may be surprising, the important point to take from it is that the more life change a candidate experiences, the less likely they are to be assessed within 18 months of their training course.

We asked candidates to give two reasons that they had registered for the Mountain Leader qualification. For their first reason, most candidates said that they had registered in order to become a Mountain Leader (n.b. this is an extrinsic participatory motive because it relates to achieving a specific outcome). The candidates who gave an ***extrinsic participatory motive for their second motive*** (e.g. "to gain employment") rather than a more intrinsic one (e.g. "to spend more time in the mountains") were more likely to have been assessed 18 months after their training course. This finding suggests that having more than one extrinsic participatory motive is important for candidates getting to assessment.

Goal setting has been shown to improve outcomes in a number of domains (see Weinberg & Gould, 2014 p 356). One way that **goal setting facilitated by training course staff** may have helped candidates is by enabling them to maximise the benefits of the time that they spent consolidating their skills and preparing for a Mountain Leader assessment after the training course. In addition to this, goal setting may have made it more likely that candidates would prepare for an assessment. The more specific these goals are, the more they will have focused candidates' attention and efforts towards being at the right level to pass an assessment. Further, *goal setting will have helped facilitate mastery experiences (i.e. having an experience where one is successful), the strongest source of self-efficacy* (Bandura, 1982); thus, this goal setting will have helped female candidates develop their confidence, which as discussed below, is key for female candidates getting to assessment.

If candidates feel that becoming a Mountain Leader is important to them, they may also feel that it is important that they are good enough to pass when they get there. This suggestion helps to explain why candidates who were assessed felt that **ideally, they would have a higher number of QMDs at assessment.** Another explanation could be that candidates who have not received goal setting support have fewer clear goals and do not feel that they can use the time as efficiently, therefore feel that they would ideally have more QMDs before being assessed.

The results presented in *Section 3.1.4 and Section 8.3.3* show that female candidates who are assessed within 18 months of their training have higher levels of **self-efficacy pre-assessment** than those who are not and that these higher levels of self-efficacy are associated with experience gained after the training course. These items are about areas of the syllabus relating to hazards and emergency procedures, where mistakes may have serious and immediate consequences for other people. It may be especially important for course staff to help female candidates set goals that help them develop their confidence to perform these tasks.

Discrepancies between the ideal and post-training levels of self-efficacy were not selected as important discriminatory variables, whilst three of the **pre-assessment self-efficacy** items were. This would suggest that it is not the discrepancy that is important, but the pre-assessment levels of self-efficacy, which will be influenced by candidates' experiences and how much preparation they feel that they have done. This hypothesis is supported in *Section 8.3.3.1* where there is evidence of a positive relationship between experience and confidence, which is stronger for female candidates than it is for male candidates.

It is both interesting and important to note, that 10 of the 11 the features in this discriminatory subset relate to the consolidation period. Considering this combination of variables, the timing of them, and the relationship between the number of QMDs and pre-assessment self-efficacy; the importance of female candidates gaining additional and relevant experience after their training course becomes paramount.

4.5 PASSING FIRST TIME

The **further candidates live from a mountainous region,** the more difficult it will be for them to gain relevant experience. Furthermore, it is also less likely that they will be able to access support specific to becoming a Mountain Leader as it is less likely that becoming a Mountain Leader is normal in their
social context.

It is clear from analyses not reported here that the first time pass rate for the Mountain Leader qualification is lower for **non-White-European candidates** than it is for White-European candidates[5] and also that the proportion of non-White-European candidates who are assessed is much lower than the proportion of White-European candidates who are assessed[6]. There are many plausible explanations for this, which may include social, cultural, and economic factors. However, there is little empirical evidence to support any of them at the moment and it is beyond the scope of this report to examine this issue further.

The facilitation of goal setting by course staff was also an important factor for passing first time. In addition to helping candidates set goals, the **provision of structure by training staff,** by making it clear to candidates what they need to do to pass an assessment, was important. The provision of structure may have benefited candidates by helping them to set very clear and specific goals, which are more effective than broad and/or vague goals for influencing behaviour change (Gould, 2005).

There are a number of reasons that **extraversion** may be linked with passing, including differences in levels of physiological arousal, which can influence the breadth of perceptual cues that individuals pay attention to, and decision making (Hardy, Jones, & Gould, 1996). Extraversion has also been linked with effective leadership (Judge, Bono, Ilies, & Gerhardt, 2002). It is important that candidates are able to pay attention to perceptual clues, make good decisions and display effective leadership in order to pass an assessment. There is also evidence that *goal setting reduces the distractibility of extraverts*, helping them maintain focus in training (Woodman, Zourbanos, Hardy, Beattie, & McQuillan, 2010), therefore, goal setting may be particularly important for extraverted candidates.

The Mountain Leader assessment is a very stressful experience for many candidates. Therefore, it is unsurprising that ***received emotional support*** and **perceived esteem support available** are positive predictors of passing. Having these types of social support may help candidates cope with the pressure of assessment (Freeman, Coffee, Moll, Rees, & Sammy, 2014; Freeman, Coffee, & Rees, 2011). However, as seen above, perceived esteem support is a predictor of male candidates not getting to assessment. These findings would suggest that esteem support should be used sparingly, or only in the right context (i.e. when candidates are ready to be assessed).

Seven of the 23 candidates who did not pass their first assessment were only deferred because they had too few **Quality Mountain Days in their logbook at assessment.** *It is important to highlight that the features presented here discriminate between candidates who do and do not pass their assessment, not between candidates who are and are not good enough to pass a Mountain Leader assessment, in terms of their skills and decision making.* If we removed these particular candidates from the sample, we would have too few cases to perform the analysis, therefore, it is difficult at this juncture to answer the question "Is having more than the minimum experience beneficial for passing a Mountain Leader assessment." If anything, it is evidence that one can pass the practical element a Mountain Leader assessment with *fewer* than 40 QMDs.

[5] *Analysis of data on CMS shows that the pass rate for non-White-European candidates has been lower than for White-European candidates since at least 2010.*
[6] *This is in general and not just after 18-months.*

The results presented in Passing first time also suggest that candidates who include **Quality Hill/Moorland Days** in their DLOG are less likely to pass. Whilst **it is unlikely that this experience is detrimental to their performance at assessment,** Quality Hill/Moorland Days are not as relevant as QMD experience. One explanation for this finding is that candidates who feel they have a weak logbook want to show all the experience that they believe is relevant, whereas a candidate who thinks they have a strong logbook may only feel the need to include the experience they believe is most relevant. Further, candidates who live further from the mountains may be trying to prepare for a Mountain Leader assessment in non-mountainous terrain as it is more accessible to them.

Nine of the 10 candidates who **attended a Mountain Skills** course prior to being assessed and responded to the survey, passed their first Mountain Leader assessment[7]. This suggests that additional structured training helps candidates to successfully prepare for an assessment.

When considering the discriminatory features presented above in a holistic manner, it is important that whilst preparing for their assessment, candidates gain enough relevant experience in the consolidation period, using clear and specific goals developed from training. In addition, it is vital that they are able to cope with the pressures of the assessment process, drawing not only on their experience relevant to the Mountain Leader qualification (i.e. QMDs), but also on social support when necessary.

4.6 LIMITATIONS

Several limitations can be identified in this project. Firstly, most of the data used were collected retrospectively. Retrospective data will be less accurate as time increases between the event and when participants are sampled, and people may create their own narrative retrospectively which may or may not reflect reality. An example of this could be a candidate who did not pass their first assessment attributing their failure to the coaching (or lack thereof) they received on their training course.

Secondly, there is some evidence of sampling bias in the data used to identify the important discriminatory factors for both getting to assessment and passing. The proportion of female and male candidates who did get to assessment within 18 months of their training course is not the same in the retrospective data (females = 23.21% and males = 41.35%) as it is in the population of candidates trained in the same period (females = 19.02% and males = 30.22%). In addition to this, the proportion of males who did not pass their first assessment is not the same in the retrospective data (13.5%) as it is in the prospective data (19.6%) or in the population[8] (19.8%); there is no evidence of the same problem in the data collected from female candidates. The simplest explanation for this is that candidates who are not assessed and male candidates who do not pass their first assessment are less likely to ***retrospectively*** respond to the survey.

Whilst there may be a subset of candidates that are not represented in the data collected as part of this project, a limitation of almost any research, we believe that the findings presented in this report can be used to make a positive impact on the completion rate of the Mountain Leader qualification. This belief is based not only on the analyses of retrospective and prospective data presented here, but their congruence with the results from the *initial qualitative study* and existing literature.

Further analysis of these data in the future should mitigate this sampling bias so that the response rate in the prospective data is similar to that in the population and the impact of recall bias is reduced. However, a truly prospective study that collected data from candidates at registration, training, and during their consolidation phase would likely overcome the limitations described above.

[7]The candidate who did not pass attended a Mountain Skills course 35 days before the start of their assessment and their training course 107 days before their assessment (all with the same provider). They also had an additional seven days experience (Dartmoor & Snowdonia) between the Mountain Skills course and their assessment.
[8]Candidates who were first trained after 2016.

5 - Future directions

The most impactful implications to come out of these findings will be those realised through conversation between Mountain Training stakeholders and Bangor University. The results presented in this report will also be presented in November 2019 at the Mountain Training United Kingdom and Ireland council meeting. Following this we are proposing that we conduct a workshop with relevant stakeholders to identify the most important implications, which can then be fed into an executive group that can establish recommendations for change, based on the evidence presented. However, below are some suggested implications, interventions, and areas for future research.

5.1 POTENTIAL IMPLICATIONS AND INTERVENTIONS

5.1.1 Course staff training

Whilst the dissemination of this report may help some providers to better support their candidates, it is likely that specific education and training will have a greater impact. One example of this would be training course staff over a number of sessions, to help them provide psychological skills coaching, in particular goal setting. While it is likely that many course staff engage in excellent practice already, there may be opportunities for adapting aspects of that practice to gain even greater benefits. This training could be based on previous interventions that show that developing more indivdualised support with coaches over an extended period leads to greater understanding and use of psychological skills (e.g. Arthur, Callow, Roberts, & Glendinning, 2019; Callow, Roberts, Bringer, & Langan, 2010).

5.1.2 Individualised candidate support

Whilst this report has presented stereotypical candidate profiles based on mean values, the needs of each individual candidate will vary. Given that understanding of the qualification pre-training is an important discriminatory variable for male candidates getting to assessment within 18 months of their training, improved signposting to relevant qualifications at the point of registration may reduce the number of candidates who attend a Mountain Leader training course and then realise that it is not what they need or that they do not have time to effectively prepare for an assessment.

For candidates who have attended a training course, there are a number of simple additions to the pathway that may increase their likelihood of being assessed. An example of this would be using a “monitoring tool” six months after their training course to assess their progress, confidence to perform specific tasks, and intention to be assessed. Individual responses to this monitoring tool could then be used to provide targeted support; for example, a candidate who has made little progress may be offered goal setting support aimed at helping them to make more progress. Alternately, a candidate who feels that they have made lots of progress towards becoming a Mountain Leader but does not feel confident in their ability to look after others in steep ground might be sent details of “steep-ground refresher” courses with approved providers. A tool like this could be particularly useful in identifying candidates who are struggling to gain additional, relevant, experience post-training and offering support to them that would help them effectively prepare for an assessment.

5.2 FUTURE RESEARCH

5.2.1 *Validation of the discriminatory feature subsets*

Given the retrospective nature of most of the analyses reported above, it would be prudent to analyse the data which has been collected in a prospective fashion. Doing so would help us to understand what influence, if any, attributional and sampling bias have had on these findings.

5.2.2 *Self-efficacy*

Candidates' confidence to perform tasks related to a Mountain Leader assessment, particularly those relating to hazards and emergency procedures, are important for candidates both getting to and passing a Mountain Leader assessment. This experience unsurprisingly appears to be related to the relevant experience a candidate has, however the strength of this relationship is not the same for all candidates, specifically female and male candidates.

Performance accomplishments, followed by vicarious experiences, verbal persuasion, and emotional arousal have the greatest effect on self-efficacy, and a negative experience of a given magnitude will have a greater effect than an equivalent positive experience (Bandura, 1977, 1982). Therefore, understanding how candidates perceived their experiences whilst consolidating and how, if at all, their self-efficacy changes over time would be a worthy topic of inquiry. It is possible that through the use of specific questions and prompts whilst logging experience on DLOG that Mountain Training can help maximise the positive effects of experience and minimise the negative ones. It may also be useful to understand the latency of the effect experience has on self-efficacy. That is, how long does the benefit of a QMD last, or how long does it take to get over a negative experience? Understanding the answers to these questions would be useful in helping candidates fit efficient and effective preparation into their lives.

5.2.3 *Ethnicity*

It is clear that non-White-European candidates are both less likely to get to assessment and also to pass their first assessment, however, the causes of this are not clear from this report. Three study ideas are listed below in increasing levels of complexity and potential for understanding differences in completion rates based on ethnicity:

1. Examine the survival rates and pass rate for different ethnic groups across a range of qualifications.
    (a) Are the results the same for qualifications that cost less in terms of both time and money?
2. Using publicly available socio-economic data examine the relationships between demographics, economic status, and completion of various Mountain Training qualifications.
3. Mixed-methods research project that aims to identify potential barriers to non-White-Europeans registering for and completing Mountain Training qualifications.

6 - Conclusion

This project has examined a wide range of factors that were believed to influence completion of the Mountain Leader qualification. Feature subsets have been identified, which discriminate female and male candidates who are assessed within 18 months of their training from those who are not and candidates who pass their first assessment from those who do not. The findings presented in this report suggest that whilst Mountain Training's qualification pathway is effective, there are several ways in which additional support could be provided to candidates, particularly during the consolidation phase of the pathway.

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8 - Appendices

8.1 APPENDIX A: GLOSSARY OF TERMS

Coaching behaviours: Coaching can be considered as an attempt to improve performance by helping an individual to gain or improve their knowledge and skills and is a "type of behaviour that leaders may engage in to a lesser or greater extent" (Wagstaff, Arthur, & Hardy, 2018, p 341). Leaders may engage in coaching behaviours and some models of leadership (e.g. transformational leadership theory (Bass, 1985) include elements of coaching behaviours. Wagstaff et al. (2018) describe five coaching behaviours, based on sport and business coaching models: 1) observing and performance analysis, 2) asking effective questions, 3) facilitating goal setting, 4) providing developmental feedback, and 5) providing motivational feedback.

Goal setting: When appropriate and specific, goals will motivate individuals to act. Goal specificity, proximity, and difficulty will all influence subsequent performance (Hardy et al., 1996), that is, goals that are more specific, closer in time, and more difficult (but still accepted) will have a more positive impact than those which are more general, distant in time, easier to achieve or so difficult that they are not accepted.

Learning data: This data is used to identify relationships between variables and the best predictive model. Also know as "training data."

Mastery experience: Experiences of success, which arise from effective performance (Bandura, 1977).

Need supportive behaviours: Behaviours that support the three basic psychological needs proposed by self-determination theory (SDT; Deci & Ryan, 1985, 2000): *competence*, the feeling of mastery and effectiveness; *relatedness*, feeling connected and involved with others; and *autonomy*, feelings of volition, choice, and internal control. SDT suggests that the satisfaction of these three needs is essential for optimal-functioning, good mental health, and well-being.

SDT suggests that every motivated behaviour can be placed on a continuum, from autonomous to controlled. **Intrinsic motives** (e.g. a person engaging in an activity because they find it interesting and enjoyable) will be closer to the autonomous end of this continuum, whereas **extrinsic motives** can range from relatively autonomous (e.g. doing something because it is seen as important) to more controlled (e.g. doing something to gain external approval or reward). Some researchers have suggested that motives exist on a number of levels, namely, dispositional motives, participatory motives, and regulatory motives (Ingledew, Markland, & Ferguson, 2009).

Deci and Ryan (2000) suggest that an environment which supports an individual's basic psychological needs will foster more autonomous forms of motivation. SDT suggests three aspects of an environment which will foster more autonomous forms of motivation (see Markland & Tobin, 2010):

1. **Autonomy** supportive environments will help an individual to feel that they are acting in line with their goals and not those of others.
2. The provision of **structure** helps individuals to develop clear expectations and helps them to believe that they are able to perform tasks successfully.
3. **Involvement** is concerned with the degree to which an individual feels that important others are genuinely interested in them.

Participatory motives: The content or "what" of candidates' goals. Something that they are trying to attain or avoid.

Perceived esteem support: One's perceived potential to access support that bolstered their sense of competence or self-esteem if needed (Freeman et al., 2011).

Pre-assessment: When starting the survey, candidates were asked, "Have you attended a Mountain Leader assessment course?" If they answered "yes", then the wording for these pre-assessment variables asked them to think about how they felt or what they experienced

immediately prior to their first assessment course. If they answered "no," the questions asked them how they felt *now, or what they had experienced recently.*

Received emotional support: The specific help one has received during a specified time period that makes them feel loved and cared for (Freeman et al., 2011).

Regulatory motives: The perceived loci of causality or "why" of candidates' goals.

Self-efficacy: An individual's confidence in their ability to carry out a specific task at a given time (e.g. navigate to a chosen point on a map in any weather) is known as their self-efficacy (Bandura, 1977). Personal experiences, followed by vicarious experiences, have the greatest effect on self-efficacy and a negative experience of a given magnitude will have a greater effect than an equivalent positive experience (Bandura, 1982).

Survival analysis: A method for analysing the expected duration of time until an event occurs.

Theory of planned behaviour: The theory of planned behaviour suggests that an individual's intention is the closest predictor of their behaviour and that this intention is influenced in turn by three belief-based perceptions about behaviour: 1) attitudes, 2) subjective norms, and 3) perceived behavioural control (Ajzen, 1991). Perceived behavioural control is similar to self-efficacy as it reflects an individual's belief that they can engage in a specific behaviour. Perceived behaviour control and attitudes are stronger predictors of intention than subjective norms (Jacobs, Hagger, Streukens, De Bourdeaudhuij, & Claes, 2011).

Test data: This data is used to test the predictive validity of the model developed using the learning data.

8.2 APPENDIX B: PATTERN RECOGNITION ANALYTICAL PROCEDURE

Using Weka open source software (Frank, Hall, & Witten, 2016) we employed a pattern recognition technique that aims to identify the most important **discriminatory** variables between two groups of people in a given sample. Pattern recognition has been developed specifically for analysing data from what are known as "short and wide" data sets (i.e. datasets that contain more variables than cases), and has successfully been used in a number of recent studies to examine differences between athletes of different performance levels (e.g. Güllich et al., 2019; Jones et al., 2019). Pattern recognition comprises a three-part process. First, we aim to identify a set of features which correlate well with the class but have a low correlation with one another (feature selection). Then we test the ability of this feature subset to correctly classify the candidates (classification). Finally, we refine the feature subset to identify the simplest solution that best explains the data (recursive feature elimination).

Best practice guidelines recommend that feature selection is carried out using a number of different methods (Jones, Hardy, & Kuncheva, 2017). With this in mind we used four feature selection algorithms, each of which works in a different way: Correlation Feature Subset with a Best First Evaluator (Hall, 1999), Correlation Attribute Evaluator, Relief-f (Kira & Rendell, 1992), and Support Vector Machine - Recursive Feature Elimination (Guyon, Weston, & Barnhill, 2002). All of these are well established feature selection methods and the greater the number of algorithms which select a feature, the more confident we can be that it is important. We then created two feature subsets, the first is of features selected by at least two feature selection algorithms and the second is those selected by at least three algorithms.

We then ran classification analyses on each of the feature subsets, again using four different (classification) algorithms: Naïve Bayes (NB; John & Langley, 1995), Sequential Minimal Optimization (SMO; Platt, 1998), Instance Based Learning (IBk; Aha, Kibler, & Albert, 1991) , J48 Decision Tree (J48; Quinlan, 1993). In a similar vein to the feature selection step, the more consistent the classification accuracy for a feature subset, the more confidence we can place in the predictive validity of that subset.

Finally, we repeated the classification analyses for the feature subset containing features selected by at least two algorithms, but then removed the feature that was ranked as least important by the SMO classifier, and re-ran the experiment again. We repeated this process until the classification rate no longer improved and the remaining features were retained as a third feature subset. We then examined the classification profile of the three resultant subsets and retained the one with the best classification accuracy.

We carried out the pattern recognition procedure described above twice for each of the four pilot surveys. The first set of analyses identified the most important features for discriminating candidates who get to assessment within 18 months of their training from those who do not. The second set of analyses identified the features which best discriminated candidates who passed their first assessment from those who did not.

8.3 APPENDIX C: SUPPLEMENTARY ANALYSES

8.3.1 Data

We have tried to use as much of the data collected from candidates trained in 2017 and 2018 as possible in this section and replicate findings with data collected from candidates trained 2008-2016. Therefore, the number of candidates varies for each analysis and is reported with the analysis.

8.3.2 Experiences of training

Two of the 11 discriminatory features reported in *Section 3.2* are about candidates' perceptions of their training staff's behaviours, with candidates who pass their first assessment scoring higher than those who did not. Figures 7 and 8 show that this is the case for all the variables measured relating to training staff's behaviours. For reference, in a sample of 213 military recruits, mean scores ± 1 *SD* of: 3.59 ± 1.00, 3.28 ± 1.00, 3.21 ± 1.01, and 2.94 ± 1.04 were reported for the MCBS factors Observation, Effective Questioning, Goal Setting, and Motivational Feedback respectively (Wagstaff et al., 2018)[9] which appear to be lower than the scores obtained in our data.

It would be wrong to conclude that the staff who trained candidates who do not pass have not displayed coaching or need supportive behaviours. However, the staff of candidates who do pass have displayed *high* levels of coaching and need supportive behaviours. Given that these results are from candidates who had been assessed before responding to the survey, another interpretation of these results is that candidates who have passed attribute their success, at least in part, to their training course staff and similarly, the candidates who do not pass attribute their failure to their training course staff (Hardy et al., 1996). **Candidates who pass their first assessment retrospectively perceive their training course staff to display high levels of coaching behaviours and need supportive behaviours.** Analysing data from candidates who are assessed after they responded to the survey once a sufficient number have been assessed will help us better understand the direction of causality for this finding.

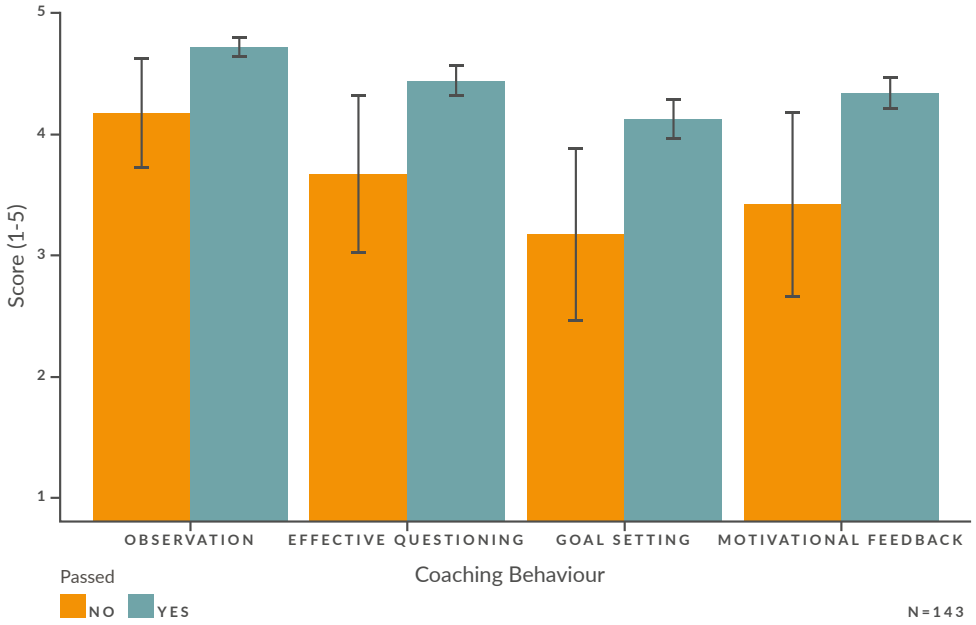

Figure 7: Group 5 candidates' rating of training course staffs' coaching behaviours (1-5), columns represent group means with 95% confidence intervals.

[9] *n.b. These scores were calculated using the full measure for each factor.*

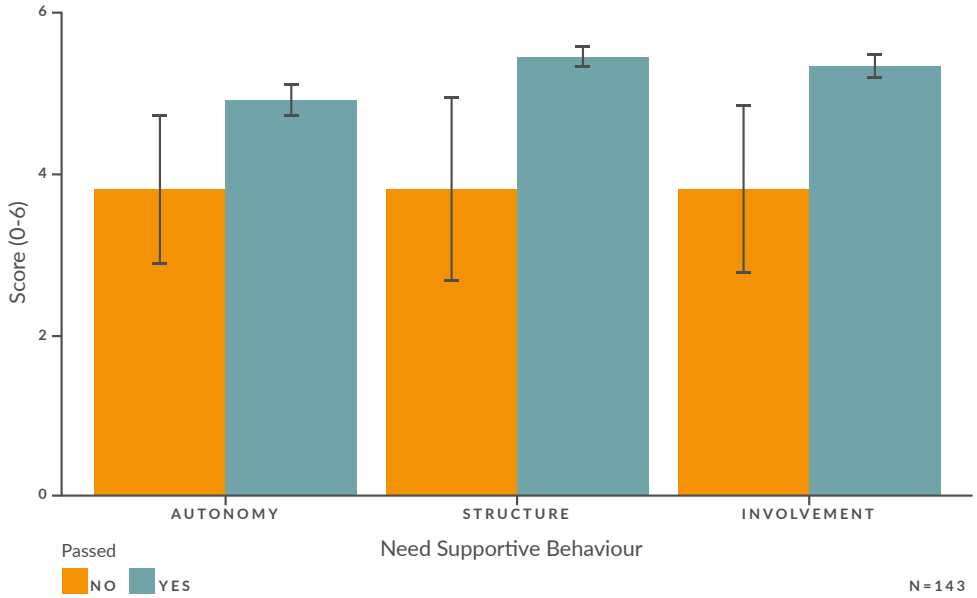

Figure 8: Group 5 candidates' rating of training course staffs' need supportive behaviours (0-6), columns represent group means with 95% confidence intervals.

8.3.3 Mountain Leader related self-efficacy

A number of Mountain Leader related pre-assessment self-efficacy items were selected in the best feature subsets in the *getting to assessment analyses* and the results of *Study 1* suggest that candidates need to be confident enough in their skills in order for them to be assessed and that there will be sex-differences in self-efficacy levels. More specifically Study 1 offered two hypotheses:

- H_1: Female and male candidates will not have different levels of Mountain Leader related self-efficacy
- H_2: In their ideal world, female candidates will have higher levels of Mountain Leader related self-efficacy than male candidates would in theirs

Using the data collected from candidates trained from 2017-2018, it is evident that both female and male candidates who are assessed within 18 months of training have significant increases in their self-efficacy totals from training to assessment, but candidates who are not assessed do not. Female candidates who are assessed also have higher self-efficacy totals pre-assessment, but not post-training, than those who are not assessed; male candidates who are assessed have higher self-efficacy totals post-training and pre-assessment than those who are not (Figure 9). This finding was replicated using the data from candidates trained 2008-2016 (n = 519).

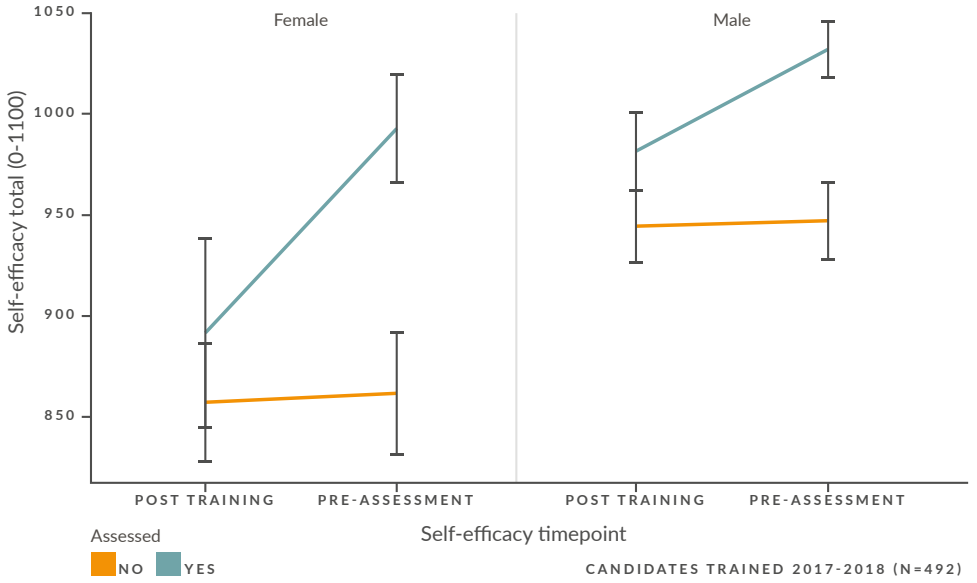

Figure 9: Changes in total self-efficacy scores over time for female and male candidates.

8.3.3.1 *Sex differences*

Analysis of the data collected both for the preliminary and main studies show that female and male candidates do have different total levels of Mountain Leader related self-efficacy post-training and pre-assessment (Figure 9), but they do not have different ideal levels of self-efficacy. This finding was replicated using the data from candidates trained 2008-2016 (*n* = 1,056).

Self-efficacy and personal experience are intrinsically linked; Figure 10 shows two important things:

- **The relationship between experience and confidence is stronger for females than it is for males,** possibly because at lower level of experience, females are less confident that males.
- **Candidates with more experience feel more confident.**

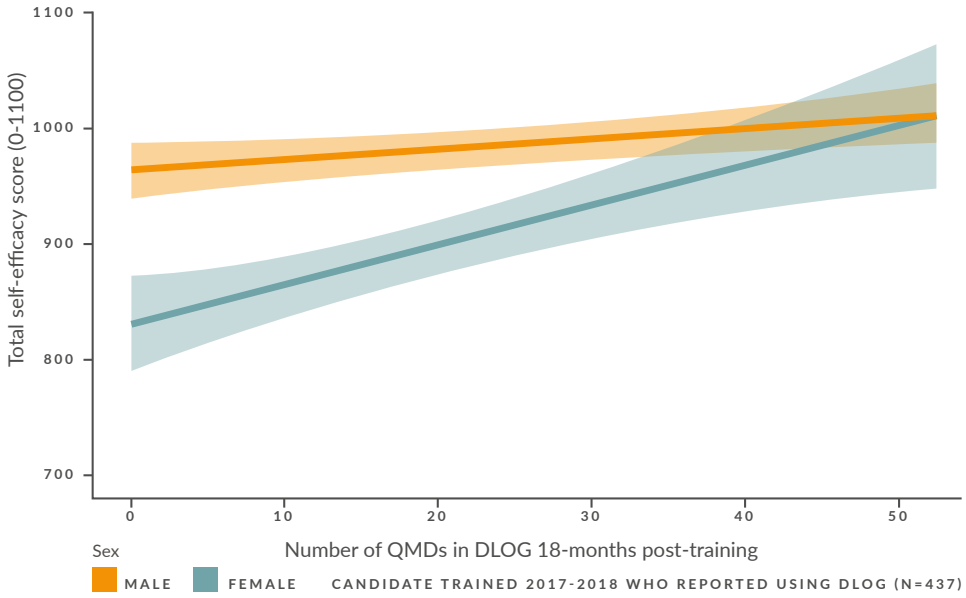

Figure 10: The interactive relationship between experience, sex, and confidence.

8.3.4 *Expectations and intentions*

A commonly cited reason for candidates not going onto a Mountain Leader assessment after a training course is that, "they only wanted to do the training course." Data collected from a survey of candidates trained from 2008-2016 suggests that at the point of registration, this is true for just 5.45% (*n* = 532) of candidates and that there is no statistically significant difference in the likelihood of being assessed 18 months post-training based on this intention.

However, the strength of a candidate's intentions of being assessed or not, scored on a scale from "no intention of being assessed" (0) to "every intention of being assessed" (100), is higher at the start and end of training for those who are assessed 18 months post training from those who are not; there is no difference in the mean strength of intention to be assessed at registration, but there is both at the start and end of the training course (candidates trained 2017-2018, *n* = 125)[10]. **This finding suggests that most candidates *do intend to be assessed* but this intention must be strong, both at the start and end of the training course, for them to get to assessment.**

We asked candidates who had not been assessed when they completed the survey about their intention to be assessed at that point. Most candidates did still intend to be assessed to some degree. The strength of their intention predicted if they would be assessed in the six months after completing the survey: 287 candidates had not been assessed (*M*intention = 81.98) and 47 had been (*M*intention = 95.96). In the data collected from candidates trained 2008-2016 there were differences at registration as well as the start and end of training, but candidates were either asked about their intention at registration or their intention at the start and end of their training course.

[10] *This is true for both sexes when the data are analysed separately.*

8.4 APPENDIX D: THE RESEARCH TEAM

This research has been conducted as part a KESS 2 PhD project and funded by the European Social Fund. The researchers involved are all from the *Institute for the Psychology of Elite Performance (IPEP).*

Will Hardy

Will graduated in 2014 from Bangor University with a first-class honours degree in Geography, having completed a research project titled "Decision making in Scottish avalanche terrain". The psychology behind the way in which different people use the mountains led Will to IPEP and this collaborative project with Mountain Training UK. Will has a number of other research interests including better understanding the psychological factors influencing decision making in high-risk mountain sports, psychological resilience, and mental health. Most of his spare time is spent in the mountains, running or climbing. Will is also a qualified Mountain Leader and has been an active member of Llanberis Mountain Rescue Team since 2014.

Dr Ross Roberts

Ross is a senior lecturer in sport and exercise psychology, and a member of the IPEP. His research interests centre on various aspects of performance psychology, he is particularly interested in the effects of personality in relation to performance and health, and also on factors that influence achievement and progression within high level sport. Much of his work is collaborative and involves organisations from the high-performance domain. In recent years he has received research funding from a variety of sources including the Ministry of Defence, Rugby Football Union, UK Sport, England and Wales Cricket Board, Sport Wales, and the European Social Fund. He has also recently completed work with the Outdoor Partnership on understanding the state of outdoor activity provision. He is also a chartered psychologist and associated fellow of the British Psychological Society and a Health Care Professions Council registered sport and exercise psychologist. He has over 15 years' experience working with high level performers and coaches in sport and military settings on a variety of performance-related issues, and also supervising aspirant psychology practitioners. A keen fell runner, when he is not working, he can usually be found in the hills and has previously completed both his Mountian Leader and Rock Climbing Instructor Training.

Prof Lew Hardy

Lew was one of the first professors of sport psychology in the United Kingdom and is one of a very small number of people to have given keynote and invited addresses at all the major sport psychology conferences in the world. He has over 100 full length research publications and served three Olympic cycles as chairperson of the British Olympic Association's Psychology Steering Group (from 1989 to 2000). His central research interest is the psychology of very-high level performance, including the effects of stress, mental toughness, motivation, the utility of psychological skills and strategies, transformational leadership, and teamwork. He has been responsible for over £1 million of grant capture and has equal applied experience of working across military, business, and sport domains. In addition to his academic career, Lew is an IFMGA British Mountain Guide and has been involved in the training of aspirant guides.

KESS

Knowledge Economy Skills Scholarships (KESS 2) is a pan-Wales higher level skills initiative led by Bangor University on behalf of the HE sector in Wales. It is part funded by the Welsh Government's European Social Fund (ESF) convergence programme for West Wales and the Valleys.

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