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The Effectiveness of a Peer-Supporter Programme to Manage Opiate Misuse in England

Introduction to Statistical Thinking and Data Analysis
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The Effectiveness of a Peer-Supporter Programme to Manage Opiate Misuse in England

Abstract

Background
Mortalities resulting from opiate overdose have risen by over 10 deaths per million people since 2008. Rehabilitation of opiate misuse has the potential to reduce dependence and in turn the mortality rate. In an effort to improve rehabilitation treatment, the NHS has conducted a trial into the effectiveness of a peer mentor support programme.

Methods
Statistical methods were used to find effects of injecting history on whether the rehab programme was successful. Regression outputs were used as evidence for any correlation that may have existed between opiate use duration and the success of the therapy. Regression was also used to find if the peer mentoring programme had any effect on relapse to opiates, and social well-being.

Results
Not having injected and duration use were found to be significant factors in rehab success. The null hypothesis that the peer mentor programme did not affect relapse could not be rejected due to statistical insignificance. Additionally, the mentoring programme showed itself to have a positive effect on overall social well-being a year after rehab.

Conclusions
A focus must be placed on reducing the amount and duration of opiate usage. No substantive association could be drawn between the post rehab peer mentoring programme and substance relapse, thus further research may be required in this area. The mentoring appeared to have assisted significantly in the patients' social reintegration. There is not yet enough evidence for the peer mentoring to be made into a standard intervention following rehabilitation therapy.

Introduction

Opiate related mortalities have been on a steady incline in England since 2012, the majority of which are due to substance overdose. The cause of over half of all drug related deaths in England throughout 2018 involved an opiate such as heroin or morphine. Moreover, opiates are the most significant contributors to poisoning as a result of controlled drug usage[1]. Current mortality rate stands at 38 deaths per million people (Figure 1)[2].

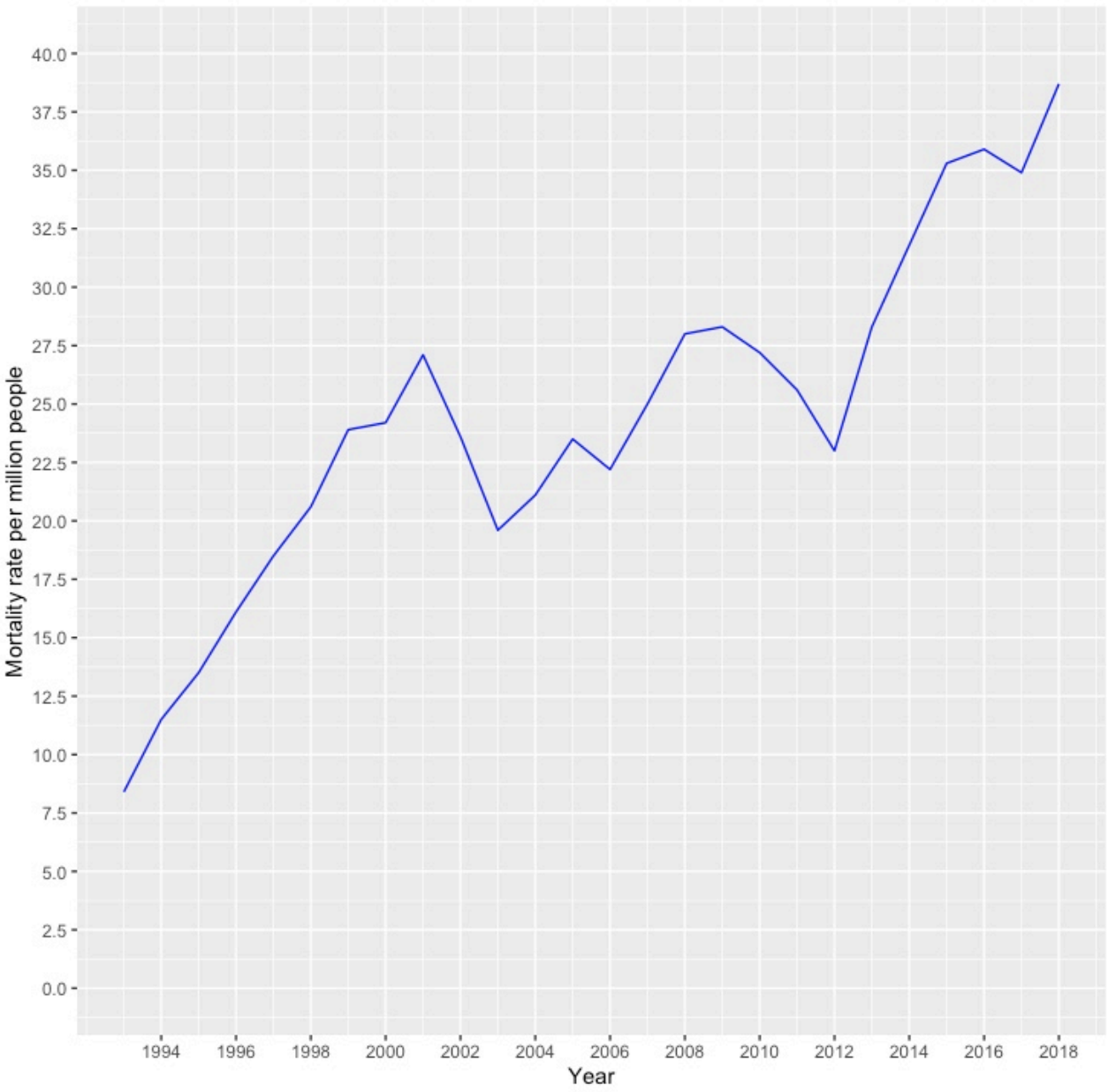

Figure 1: Mortality rate for opiates from 1993 to 2018. Source: Office for National Statistics

However, in addition to a heightened risk of death, there are also social, financial and mental health costs that stem from substance misuse, which have a much wider impact. Opioids can cause those who develop a dependency on them to seek out the possession and use of these drugs over other activities in their life. Furthermore, this can lead to breakdown in the individual's personal and professional relationships. As a result, job loss, financial ruin and domestic abuse are among the consequences of opiate abuse.

Ambiguity exists around the effectiveness of rehabilitation programmes on relapse to the substance, as well as the other social implications of drug dependency[3]. A greater focus on improving intervention methods is of paramount importance given the rise in opiate abuse over the past decade.

Methods

Subjects

The data set was obtained from the results of a randomised control trial conducted by NHS England. The trial was led with the purpose of analysing the efficacy of a peer mentoring programme subsequent to concluding rehab therapy for opiate misuse, and took place for five months halfway through 2017. Four different regions of England were used to undertake the trial: North West, North East, South East and the West Midlands. The study sample consisted of all 864 patients in the data set. Each patient was randomly allocated to an arm of intervention: the peer mentoring programme or regular standard of care.

The peer mentoring intervention saw patients be assigned to a mentor following completion of rehab, who they met and spoke with weekly as well as taking part in occasional social events as a form of post rehab counselling.

All patients were followed up on until the conclusion of the trial in mid 2019. Of all the subjects in the data, 619 completed the study, while 245 were lost to follow up.

Data management

Statistical methods were applied to the original dataset using the R software package. Each observation contained data entries for several independent variables. These included demographic characteristics such as age, sex and region of residence. Treatment related characteristics comprised of opiate use duration and injecting history. Additionally, initial rehab therapy success was measured as completing the study having abstained from substance use. Figure 2 outlines a summary of the data and its variables.

Figure 2: Summary of the data set

```
      id           gender         age                 region    residence    duration_use
Min.   :  1.0   female:228   Min.   :20.00   North East   :213   rural:273   Min.   :  0.00
1st Qu.:216.8   male  :636   1st Qu.:33.00   North West   :231   urban:591   1st Qu.:  5.00
Median :432.5                Median :39.00   South East   :223               Median : 12.00
Mean   :432.5                Mean   :40.21   West Midlands:197               Mean   : 17.32
3rd Qu.:648.2                3rd Qu.:46.00                                  3rd Qu.: 24.00
Max.   :864.0                Max.   :91.00                                  Max.   :120.00

          injecting_status               housing_status                    referral_source rehab_success
Currently injecting:211     Housing problem       :154    Criminal justice          :267    No :388
Missing            : 16     No problem            :553    Health services/social care:164    Yes:476
Never injected     :363     Other                 :  9    Self/family/friends       :433
Previously injected:274     Urgent housing problem:148



         intervention  wellbeing1yr     relapse_days      last_study_obs         last_obs_outcome
peer mentoring  :434   Min.   : 9.324   Min.   :  0.0757   Min.   :  0.0   LTFU           :245
standard of care:430   1st Qu.:39.358   1st Qu.: 41.3022   1st Qu.:540.0   Study completed:619
                       Median :48.319   Median : 98.2332   Median :720.0
                       Mean   :47.868   Mean   :187.8268   Mean   :581.2
                       3rd Qu.:56.407   3rd Qu.:302.2600   3rd Qu.:720.0
                       Max.   :79.975   Max.   :716.1392   Max.   :720.0
```

This report focuses on the investigation of three main trial outcomes. Primarily, the statistical methods used are to analyse the effectiveness of the peer mentoring support programme on both substance relapse, and social reintegration into the local community. Additionally, the numerical methods were used in finding the effect of prior opiate use duration and injecting history on successful rehab completion. Thus, the outcome variables of interest include

- rehab success
- the number of days post therapy of the first drug relapse
- the individuals' social wellbeing a year after the initial treatment programme.

To examine these, several exposure variables were used within the statistical analysis.

All missing values within the set formed the exclusion criteria for this study. Omitting the missing values prevents under or overestimation of any statistical model outputs, thus reducing the potential for biased results.

Statistical analyses

Firstly, injecting status was used as an exposure variable to examine its association with rehab success, which was defined as having abstained from opiate use for the duration of the treatment. This variable was categorized as patients having never injected, having previously injected, and currently injecting. There was a total of 16 missing values in this variable, all of which were excluded from the analysis.

A 2x2 table allowed for the calculation of the odds of a successful treatment programme depending on the injecting history. Having been stratified by injecting history in the original data set, patients were further categorised into two groups for this investigation, those who had injected and those who had never injected. The injected group consisted of a total of all those who had previously injected and those who were injecting at the time of entering rehab. In turn, the odds ratio was calculated for rehab success among the group with an injecting history.

The period of opiate use prior to the therapy programme accounts for another exposure used in this study. Duration is measured in months and observations range from zero to 120 months. Due to the format of this data, a logistic regression analysis was conducted in order to assess the odds of successfully completing rehab treatment among patients with varying time periods of substance misuse. Interpreting a logistic regression model must be done so in relation to the significance level, in this case the five percent significance level. A p-value of less than or equal to 0.05 would be statistically significant in the interpretation of any coefficients. A null hypothesis would be theorized as there being no association between the duration of opiate use prior to treatment and the success of the rehab. In order to reject this, the regression model would have to provide a p-value below the significance level cut-off value.

For the effectiveness of the peer mentoring programme on relapse to opiates, another logistic regression model was computed. The significance level taken into

consideration for all logistic regression models is unchanged from the five percent level.

The effect of the peer mentoring on social wellbeing was also studied. For this analysis, well-being score was used as an exposure variable. This composite score was recorded in the data set and calculated over several qualitative factors such as employment, housing status and personal and professional relationships. A higher score reflects a better social well-being status. The most significant statistics of the scores were logged in two tables to provide a clear contrast of the peer mentoring programme compared to the standard of care. Additionally, histograms were used to further evaluate the distribution of scores.

Results

There was a clear association between injecting history and successful conclusion of the initial treatment. The majority of patients who abstained from opiate use throughout the duration of the rehabilitation programme were those who had never injected. Out of the 476 individuals that completed the programme, 232 had not injected previously (Table 1).

	Successful	Unsuccessful	Total
Injected	236	249	485
Never injected	232	131	363
Total	468	380	848

Table 1: 2x2 table comparing injecting history and rehab success

The odds ratio for treatment success among those who have an injecting history was calculated to be 0.54 to two significant figures (95% confidence interval: 0.41, 0.71). Thus, the odds of completing the programme was 46% lower for patients that had previously injected.

In contrast, among the group of patients who had injected, there was little difference in the successful cases compared to those unsuccessful in treatment (Figure 3). Individuals injecting at the time of entering treatment did not fail the programme by a wide margin in comparison to those who succeeded (107 did not successfully complete rehabilitation compared to 104 who did). The group that had injected previously had a slightly larger difference in this number (142 unsuccessful in comparison to the 132 successful).

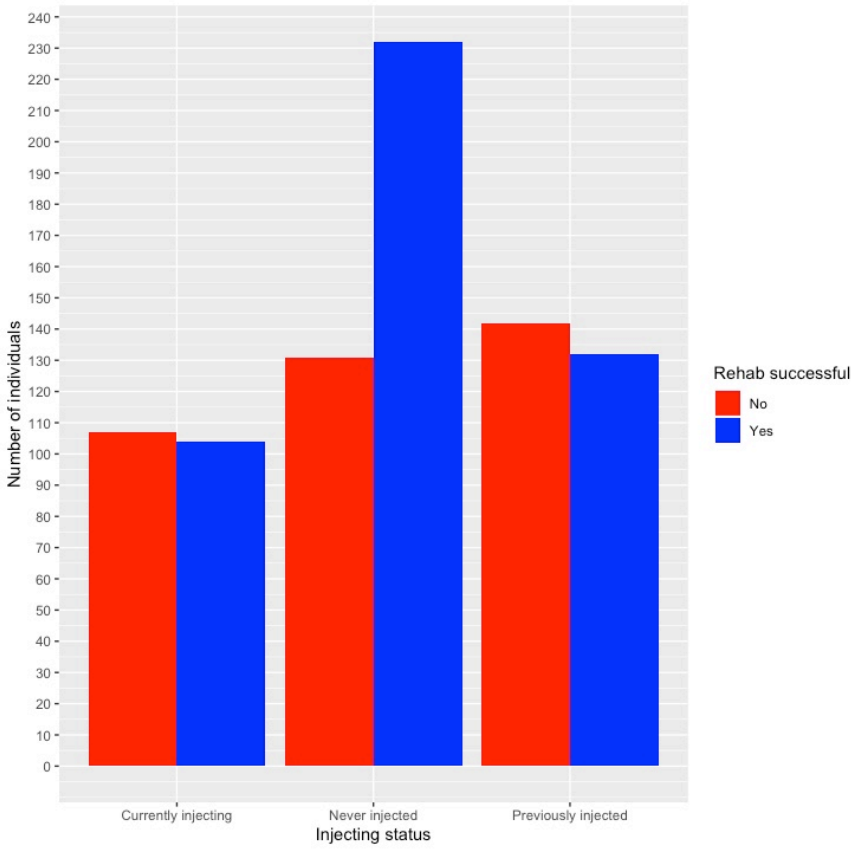

Figure 3: Rehab success within groups categorised by injecting history

Logistic regression analysis

The logistic regression model computed for the duration of opiate use and treatment success yielded a log odds estimate of -0.009959. Exponentiating this estimate produces an odds value of 0.99 (to two significant figures). So, for a one month increase in opiate use we are expected to observe an approximate 1% decrease in the odds of the rehabilitation programme being successful. A p-value of 0.0124 was returned for this estimate, which indicates this output is statistically significant at the five percent level. With this significance it can be inferred that the longer a patient had used opiates prior to seeking treatment, the less likely they were to abstain from usage throughout the therapy. Examining the intercept coefficient produced by the model provides an estimate for the odds of passing rehabilitation success when an individual had been using the substance for zero months. The log odds for this were 0.378. Taking the exponential of this value returns an odds of 1.46.

Peer mentoring effectiveness on drug relapse was also analysed through logistic regression. The coefficient calculated for this was -0.0008845. However, upon observing the p-value of 0.0684, it is clear that this statistic is not significant at the five percent level.

A two-sample t-test was calculated to further examine this. The difference in means was computed to be 31.35. This tells us there was a delay in relapse by approximately 31 days for those who received peer mentoring. However, similarly to the logistic

regression model, a p-value of 0.068 was returned with this t-test. Once again, we cannot say that there is statistical significance to this calculation.

Peer mentoring and social wellbeing

Table 2 and Table 3 outline the minimum and maximum values for well-being scores amongst patients in the data set, sorted by those who received the peer mentoring and those who received standard of care respectively. The lowest score amongst the group of patients who were given standard of care was 9.32 compared to the minimum score of 14.64 in the arm that received peer mentoring. There was only a difference of 0.205 between the highest scores in each group (79.98 for peer mentoring compared to 79.78 for standard of care).

Min.	Mean	Max.
14.64	51.05	79.98

Table 2: Statistics among group that received peer mentoring

Min.	Mean	Max.
9.32	44.78	79.78

Table 3: Statistics among group that received standard of care

Figure 4 highlights the frequency of scores for the two intervention arms. For the peer mentoring group, the modal score range is 50-55, in comparison to 40-55 for the standard of care group.

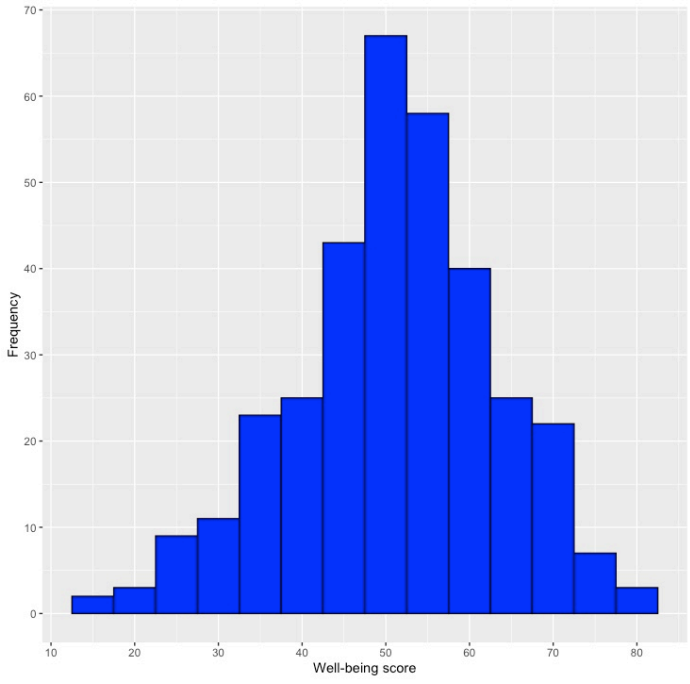

Figure 4a: Well-being score distribution among the peer mentoring intervention arm

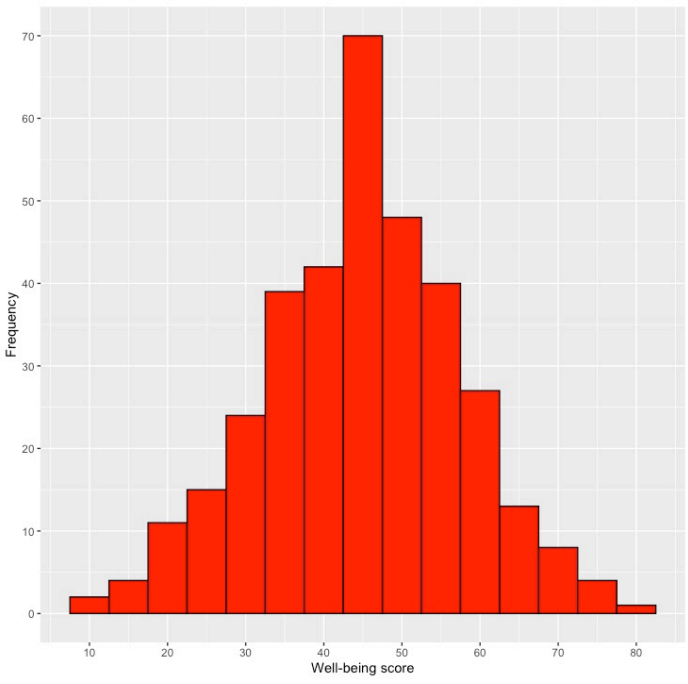

Figure 4b: Well-being score distribution among the standard of care intervention arm

Discussion

The principle findings of the statistical investigation undertaken in this report were that an association exists between the substance usage history of a patient and their progression of the initial treatment programme. Among the group of patients with no injecting history, over a hundred more patients completed treatment than those who did not. However, there does not appear to have been much of an effect on the group of patients who had injected. Amongst this subgroup, more patients with an injecting history failed the programme, though by only a small margin. The most important inference from this finding seems to be that having never injected before appears to make it easier for a patient to completely withdraw from usage during treatment, but injecting previously does not affect treatment success by a significant factor.

Conversely, calculation of the odds ratio for treatment success among patients with an injecting history tells us that this subgroup was 46% less likely to complete the programme. This is clearly contradictory to the small differences in rehab completion as observed in Figure 3. It is important to consider other factors that could account for this ambiguity. For example, methods of therapy within the rehab facility could have been more successful in rehabilitating patients such that there was a much smaller difference in the successfulness and of completing the programme.

The findings concerning duration use were somewhat expected and are supported by extant literature[4]. The greater the number of months a patient had been using opiates prior to treatment, the less likely they were to complete it while abstaining from further use. While the relationship between the exposure and the outcome was clear, the change is still a miniscule value. A 1% decrease in therapy completion for every month of substance use appears to be a rather insignificant statistic. However, it is important to consider this within the context of the data set. For example, the longest duration a patient had been using opiates for was 120 months. So, in this case, 10 years of usage statistically guarantees that the individual will not complete treatment.

It was not possible to say that there is a particular association between the peer mentoring programme and how quickly a patient relapses. This was due to the statistical insignificance of the output produced by the regression model. Thus, we could not reject our null hypothesis that there is no association between the peer mentoring programme of opiate use prior to treatment and number of days before the first drug relapse.

The peer mentoring appeared to have had an effect on social wellbeing of the patients. A much larger number of individuals that had received peer support scored in the 60-80 range than those who did not receive the support. The majority of users who received the mentoring post therapy returned a score in the 50-55 range which could be interpreted as having done averagely in social reintegration.

Considering the highest score among the entire patient data set was 79.98, there were still patients getting the standard of care that had reintegrated into society, for example, one observation which had a well-being score of 79.78. However, it is clear from the frequencies presented in Figure 4 that the peer mentoring programme did

indeed have a positive impact on the social wellbeing of patients a year on from rehab discharge.

Limitations

This analysis is not without limitation. The presence of missing values meant that certain numbers of observations would have to be removed when conducting statistical analyses. Doing so means that the sample size is reduced, which can lead to inaccurate calculations, regardless of the size of the difference in values. There is a possibility that values may have been missing not at random. For instance, individuals who could have been discharged from therapy and found themselves in a housing problem would be unable to travel to be followed up on. Another example of this is an individual who may have relapsed shortly after discharge, and would then be lost to follow-up. Out of the 864 patients in this study, 245 could not be followed up on.

Public health impact

The study has concluded that opiate usage prior to rehab admission negatively affects chances of successful treatment, regardless of whether the substance is injected or taken in any other form. Thus, there should now be a greater focus on reducing substance misuse, especially through injecting.

For the peer mentoring programme to be implemented as a standard intervention post treatment therapy, there needs to be substantial evidence that it is effective on a number of factors associated with opiate rehabilitation. Though the study may have found evidence that it has a positive impact on social well-being, it failed to find any for the effect on relapse to the drug - a significant outcome. This public health initiative would benefit from further research, whether that be further statistical investigations, or another trial in itself.

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