



# First-episode psychosis and vocational outcomes: A predictive model

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## ABSTRACT

Most studies on predictors of vocational outcomes are cross-sectional and results are varied. This study aimed to examine the vocational rates of patients with first-episode psychosis (FEP), identify factors predicting a lack of engagement in age-appropriate roles, and evaluate the predictive ability of a model with baseline sociodemographic information and 2-year symptom and functioning trajectories on vocational outcomes. The Singapore Early Psychosis Intervention Program (EPIP) has maintained a standing database on patient clinico-demographic information. The primary outcome, vocational status, was operationalized as “meaningfully employed”, that is, being gainfully employed or engaged in an age-appropriate role, and “unemployed”. Using logistic regression, the predictive ability of the proposed model was evaluated. Vocational data was available for 1177 patients accepted into EPIP between 2001 and 2012. At the end of two years in the service, 829 (70.4%) patients were meaningfully employed and 348 (29.6%) patients were unemployed. The binary logistic regression model on the prediction of 2-year vocational outcomes yielded an AUC of 0.759 (SE = 0.016,  $p$ -value < 0.001). Clinico-demographic risk factors for being unemployed at the end of two years included being Malay, single, and unemployed at baseline; having a longer duration of untreated psychosis (DUP); a diagnosis of schizophrenia, schizophreniform, or delusional disorder at baseline; and belonging to the ‘delayed response’ or ‘slower response and no response’ general psychopathology trajectories. We have proposed a model that allows vocational outcomes to be predicted with high specificity. The results of this study will be relevant in developing future intervention models to improve outcomes among FEP patients with different illness trajectories.

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## 1. Introduction

Most psychotic disorders first occur in the early twenties, at a developmentally crucial time where many begin the transition from education to employment (Kessler et al., 2007; Rinaldi et al., 2010). Being able to engage in an age-appropriate vocational role, despite the debilitating impact of the illness, brings about a sense of purpose and stability at a particularly challenging time in a person's life. Sustaining gainful employment is important in the recovery process, having been shown to increase well-being by contributing to outcomes such as symptom improvement and self-esteem (Bond et al., 2001; Reneflot and Evensen, 2014). Several meta-analyses have also indicated that unemployment may be a causal factor of distress and psychological and physical health problems (McKee-Ryan et al., 2005; Paul and Moser, 2009). Given the benefits of returning to education or employment, and correspondingly functional recovery, being engaged in an age-appropriate

academic or vocational role is understandably often highlighted as a desired intervention outcome (Iyer et al., 2011). However, despite best efforts, it is evident in clinical practice that these functional outcomes are often difficult to attain, especially without appropriately individualized and targeted interventions, given the diverse needs and characteristics of patients with psychotic disorders.

Despite the abundance of studies on predictors of vocational outcomes, most methodologies are cross-sectional in nature and results are not consistently significant across different studies. This underscores a lack of understanding and consensus on how one can predict and increase rates of functional recovery in patients with psychosis. While it is known that certain patient sociodemographic and clinical factors are predictors of vocational outcomes and mental well-being, the mechanisms behind these relationships are not clearly understood. For example, unemployment rates have been found to be markedly higher in patients with first-episode psychosis (FEP) as compared to the general population, with age and global functioning the only independent significant predictors after accounting for duration of untreated psychosis (DUP), educational level, and negative symptom severity (Ramsay et al., 2012). However, other literature has shown that sociodemographic and clinical factors have lesser impact on the

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relationship between mental health and employment, as compared to cognitive factors such as appraisals; coping abilities; and the types of intervention provided (Bond and Drake, 2008; McKee-Ryan et al., 2005; Rinaldi et al., 2010).

Differences in methodologies aside, one reason for such inconsistent findings could be explained by the heterogeneous nature of illness trajectories in psychotic disorders. The recent interest in research on the longitudinal course of schizophrenia has led to evidence for distinct symptom profiles of the disorder (Bota and Preda, 2011; Millan et al., 2016; Reichenberg et al., 2005). Using latent class growth analysis (LCGA), a local study by Abdin et al. (2017) found distinct symptom severity and functioning trajectories, operationalized by Positive and Negative Syndrome Scale (PANSS) and Global Assessment of Functioning (GAF) scores respectively across two years. The identified poorer PANSS trajectories were significantly associated with the poorest GAF trajectory, and were predicted by clinical and sociodemographic baseline factors. It is now timely to examine the implications of these illness trajectories on vocational outcomes at the end of two years of active intervention in a specialized early psychosis intervention service.

This study aimed to firstly, provide an estimate of vocational rates in patients with FEP at the end of two years of intervention; secondly, identify factors predicting a lack of engagement in age-appropriate roles; thirdly, evaluate the predictive ability of a model with baseline sociodemographic information and 2-year symptom and functioning trajectories on vocational outcomes; and lastly, as a form of comparison, evaluate the predictive ability of a model with baseline sociodemographic information and baseline clinical factors (single-point PANSS and GAF scores) on vocational outcomes. As it is inherent that a model with trajectories would encapsulate more information than one with only baseline data, it is hypothesized that the former would be a better fit to predict return to education and employment. The results of this study will be relevant in developing and tailoring future intervention models to improve functional outcomes among FEP patients with different illness trajectories.

## 2. Methods

The Early Psychosis Intervention Program (EPIP) is a nationwide program based at the Institute of Mental Health (IMH), the only state psychiatric hospital in Singapore. Patients accepted into the program fulfilled the following criteria: (a) age between 16 and 40 years old inclusive, (b) first-episode psychotic disorder with no prior or minimal treatment, and (c) psychotic disorder that is not secondary to a general medical condition or substance use. Psychotic Disorder is defined as meeting the Diagnostic and Statistical Manual of Mental Disorders IV-TR (DSM-IV-TR) (American Psychiatric Association, 2000) criteria for schizophrenia, schizophreniform disorder, schizoaffective disorder, delusional disorder, brief psychotic disorder, psychotic disorder not otherwise specified, or mood disorders with psychotic features. Intensive intervention from a multidisciplinary team of psychiatrists, case managers, occupational therapists, nurses, social workers, psychologists, and peer support specialists is provided to all patients for at least two years.

Using the international consensus statement by Bertolote and McGorry (2005) for early intervention and recovery for early psychosis as benchmark guidelines, the service has consistently maintained an assessment system and database to monitor patient outcomes. The EPIP database is an on-going registry that has been registered with the Singapore National Healthcare Group (NHG) as a free standing database. Clinico-demographic data is captured prospectively, and data integrity is maintained by stringent and regular quality checks. The rating scales employed at fixed time points (baseline, 3, 6, 12, and 24 months) in the service include the PANSS and GAF. These are completed by EPIP psychiatrists, who have undergone training in the use of these instruments and sessions to establish inter-rater reliability (0.94 in this sample) and minimize inter-rater drift. Each patient's

diagnosis according to the DSM-IV-TR and DUP (operationalized as the number of months since the onset of symptoms before treatment), and other sociodemographic information, such as age, gender, ethnicity, marital status, educational level, and vocational status, is also recorded by the treating psychiatrist and assigned case manager respectively at baseline contact. The outcome of interest, vocational status, options for which include meaningfully employed (gainful employment or engagement in an age-appropriate role) and unemployed, is also recorded by the assigned case manager, who follows up closely with the patient's psychosocial progress, at baseline and at the end of two years in the program. An age-appropriate role is defined to include homemaker, youth actively involved in public or private school and, in the case of Singaporean males above 18 years of age, enlistment in compulsory military service. Participants had to be actively involved in these roles for the preceding three months to qualify as meaningfully engaged at the time of assessment.

The classification of subjects into symptom and functioning trajectory groups using LCGA was provided by Abdin et al.'s (2017) original paper. In their study, two discrete trajectories were identified for positive symptoms – 'early response and stable' (early reduction in symptoms followed by maintenance of low-level symptom severity) and 'delayed response' (initial response to treatment followed by steady reduction in symptoms). Four discrete trajectories were identified for both negative and general psychopathology symptoms – 'early response and stable', 'early response and relapse' (early reduction of symptoms followed by relapse), 'delayed response', and 'slower response and no response' (early response to treatment followed by no response). For functioning, three distinct trajectories were identified – 'high functioning' (significant improvement over time), 'moderately stable functioning' (initial response to treatment followed by maintenance), and 'deterioration in functioning' (minimal improvement followed by significant decline).

In our naturalistic study, all EPIP patients accepted into the program during the period of 2001 to 2012 were included. Ethical approval for conducting the study was received from the National Healthcare Group's Domain Specific Review Board (DSRB Reference Number: 2016/00017).

Statistical analyses were conducted using IBM Statistical Package for Social Sciences (SPSS) 23. Mean and standard deviations were computed for continuous variables, and frequencies and percentages were computed for categorical variables. Chi-square and *t*-tests were conducted to examine differences between the meaningfully employed and unemployed groups at the end of two years, and the resulting *p*-values included in the table. Using multiple logistic regressions, the predictive ability of a model with baseline sociodemographic and clinical characteristics on vocational outcomes, and a model with baseline sociodemographic characteristics and 2-year symptom and functioning trajectories on vocational outcomes, were evaluated by their classification accuracy as expressed by the area under the receiver operating characteristics curve (AUC). Multinomial logistic regression was performed to predict the change in vocational status over the two years in the service. Statistical significance for this study was established at *p*-value < 0.05.

## 3. Results

A total of 1724 EPIP patients were accepted into the program between 2001 and 2012. Vocational outcome data at the end of their two years in the service was unavailable for 547 (31.7%) patients. As compared to those with known vocational status at the end of two years, those with unavailable data were more likely to be male; married (vs. single); and have either brief psychotic disorder or psychotic disorder not otherwise specified (vs. schizophrenia spectrum and delusional disorder). Among the 547 whose data was unavailable, 274 (50.1%) were missing, 234 (42.8%) were discharged from the service early either because they were seeking psychiatric services from elsewhere (local or

overseas) or they had a revision in their diagnosis to a non-psychotic disorder, 26 (4.8%) were deceased, and 13 (2.4%) had defaulted treatment and were uncontactable.

The sociodemographic and clinical characteristics and assigned trajectory class of the remaining 1177 patients with 2-year outcome data are presented in Table 1. At baseline, 530 (45.0%) were rated to be unemployed, and 647 (55.0%) were rated to be meaningfully employed. At the end of two years in the service, 829 (70.4%) patients were rated to be meaningfully employed, and 348 (29.6%) were rated to be unemployed.

### 3.1. Sociodemographic and clinical predictors of 2-year vocational outcomes

The binary logistic regression model of baseline sociodemographic information and 2-year symptom and functioning trajectories on the

prediction of unemployment at the end of two years yielded an AUC of 0.759 (SE = 0.016,  $p$ -value < 0.001), positive predictive value of 0.64, and negative predictive value of 0.78. Overall, this model had a correct classification rate of 75.6%. In comparison, the binary logistic regression model of baseline sociodemographic information and baseline clinical factors on the prediction of unemployment at the end of two years yielded an AUC of 0.706 (SE = 0.017,  $p$ -value < 0.001), positive predictive value of 0.58, and negative predictive value of 0.74. This model had a correct classification rate of 72.4%. As hypothesized, the former model provided a better fit to predict lack of engagement in age-appropriate roles at the end of two years of intervention.

As presented in Table 2, compared to those who were meaningfully employed, those who were unemployed at the end of two years in the service were more likely to be Malay (OR = 1.73) than Chinese, less likely to be married (OR = 0.46) than single, and more likely to be unemployed (OR = 2.15) at baseline. They were also more likely to have a

**Table 1**  
Baseline sociodemographic and clinical characteristics of patients.

	Vocational outcomes at end of two years		Total (n = 1724)	<i>p</i> -value
	Meaningfully employed (n = 829)	Unemployed (n = 348)		
Age – years, mean (SD)	27.5 (6.5)	27.5 (6.5)	27.7 (6.6)	0.918
Gender – no. (%)				
- Male	387 (46.7)	192 (55.2)	875 (50.8)	0.008**
- Female	442 (53.3)	156 (44.8)	849 (49.2)	
Ethnicity – no. (%)				
- Chinese	647 (78.0)	256 (73.6)	1303 (75.6)	0.087
- Malay	98 (11.8)	60 (17.2)	253 (14.7)	
- Indian	61 (7.4)	25 (7.2)	125 (7.3)	
- Others	23 (2.8)	7 (2.0)	43 (2.5)	
Marital status – no. (%)				
- Single	642 (77.4)	304 (87.4)	1341 (77.8)	<0.001**
- Married	162 (19.5)	29 (8.3)	316 (18.3)	
- Separated	25 (3.0)	15 (4.3)	67 (3.9)	
Highest educational level – no. (%)				
- Primary	99 (11.9)	60 (17.2)	244 (14.2)	0.017*
- Secondary	279 (33.7)	127 (36.5)	612 (35.5)	
- Tertiary	451 (54.4)	163 (46.8)	868 (50.3)	
Baseline vocational status – no. (%)				
- Unemployed	309 (37.3)	221 (63.5)	768 (44.5)	<0.001**
- Meaningfully employed	520 (62.7)	127 (36.5)	956 (55.5)	
DUP – mean (SD)	12.4 (22.2)	21.5 (35.9)	14.7 (26.4)	<0.001**
DSM-IV diagnosis – no. (%)				
- Schizophrenia, schizophreniform, and delusional disorder	598 (72.1)	297 (85.3)	1283 (74.4)	<0.001**
- Affective psychosis	92 (11.1)	15 (4.3)	151 (8.8)	
- Brief psychotic disorder and psychotic disorder not otherwise specified	139 (16.8)	36 (10.3)	290 (16.8)	
PANSS scores – mean (SD)				
- Total	65.8 (17.3)	69.9 (17.5)	65.9 (17.5)	<0.001**
- Positive	19.9 (6.1)	19.4 (5.7)	19.6 (6.0)	0.207
- Negative	12.3 (6.6)	15.1 (8.1)	12.8 (7.0)	<0.001**
- General psychopathology	33.7 (9.7)	35.5 (9.8)	33.6 (9.7)	0.005**
GAF scores – mean (SD)				
- Total	40.5 (14.0)	39.4 (13.1)	40.4 (13.9)	0.177
- Symptoms	40.8 (14.2)	40.4 (13.2)	40.8 (14.3)	0.668
- Disability	46.2 (13.5)	43.3 (12.4)	45.6 (13.4)	<0.001**
GAF class – no. (%)				
- High functioning trajectory	580 (70.0)	129 (37.1)	1099 (63.7)	<0.001**
- Moderately stable functioning trajectory	233 (28.1)	194 (55.7)	567 (32.9)	
- Deterioration in functioning trajectory	16 (1.9)	25 (7.2)	54 (3.1)	
PANSS positive symptoms class – no. (%)				
- Early response and stable trajectory	734 (88.5)	278 (79.9)	1511 (87.6)	<0.001**
- Delayed response trajectory	95 (11.5)	70 (20.1)	213 (12.4)	
PANSS negative symptoms class – no. (%)				
- Early response and stable trajectory	719 (86.7)	247 (71.0)	1448 (84.0)	<0.001**
- Early response and relapse trajectory	42 (5.1)	36 (10.3)	102 (5.9)	
- Delayed response trajectory	3 (0.4)	14 (4.0)	20 (1.2)	
- Slower response and no response trajectory	65 (7.8)	51 (14.7)	153 (8.9)	
PANSS general psychopathology symptoms class – no. (%)				
- Early response and stable trajectory	710 (85.6)	228 (65.5)	1416 (82.1)	<0.001**
- Early response and relapse trajectory	50 (6.0)	44 (12.6)	111 (6.4)	
- Delayed response trajectory	8 (1.0)	22 (6.3)	38 (2.2)	
- Slower response and no response trajectory	61 (7.4)	54 (15.5)	159 (9.2)	

\*  $p$ -value  $\leq$  0.05; \*\*  $p$ -value  $\leq$  0.01.

PANSS: Positive and Negative Syndrome Scale; GAF: Global Assessment of Functioning.

**Table 2**  
Predictors of 2-year vocational outcomes with meaningfully employed as the reference category for the dependent variable.

	Unemployed		
	OR	95% CI	p-value
Age	1.00	0.98–1.03	0.808
Gender			
- Male	Ref.		
- Female	0.88	0.65–1.17	0.371
Ethnicity			
- Chinese	Ref.		
- Malay	1.73	1.15–2.59	0.008**
- Indian	1.06	0.61–1.84	0.828
- Others	0.74	0.29–1.93	0.542
Marital status			
- Single	Ref.		
- Married	0.46	0.28–0.76	0.003**
- Separated	1.37	0.65–2.87	0.413
Highest educational level			
- Tertiary	Ref.		
- Secondary	1.07	0.78–1.47	0.674
- Primary	1.39	0.90–2.14	0.138
Baseline vocational status			
- Meaningfully employed	Ref.		
- Unemployed	2.15	1.59–2.91	<0.001**
DUP	1.01	1.00–1.01	0.043*
Baseline DSM-IV diagnosis			
- Schizophrenia, schizophreniform, and delusional disorder	Ref.		
- Affective psychosis	0.48	0.26–0.90	0.021*
- Brief psychotic disorder and psychotic disorder not otherwise specified	0.76	0.49–1.19	0.226
GAF class			
- High functioning trajectory	Ref.		
- Moderately stable functioning trajectory	2.95	2.15–4.05	<0.001**
- Deterioration in functioning trajectory	3.31	1.47–7.47	0.004**
PANSS positive symptoms class			
- Early response and stable trajectory	Ref.		
- Delayed response trajectory	0.79	0.51–1.23	0.294
PANSS negative symptoms class			
- Early response and stable trajectory	Ref.		
- Early response and relapse trajectory	1.00	0.58–1.73	0.999
- Delayed response trajectory	1.98	0.47–8.38	0.355
- Slower response and no response trajectory	1.44	0.90–2.31	0.128
PANSS general psychopathology symptoms class			
- Early response and stable trajectory	Ref.		
- Early response and relapse trajectory	1.35	0.80–2.28	0.256
- Delayed response trajectory	3.63	1.34–9.83	0.011*
- Slower response and no response trajectory	1.71	1.03–2.83	0.037*

\*  $p$ -value  $\leq 0.05$ ; \*\*  $p$ -value  $\leq 0.01$ .

GAF: Global Assessment of Functioning; PANSS: Positive and Negative Syndrome Scale.

longer DUP (OR = 1.01) and a diagnosis of schizophrenia, schizophreniform, or delusional disorder (OR = 2.08) instead of affective psychosis. In terms of 2-year trajectories, those who were unemployed were also more likely to belong to the 'moderately stable functioning' (OR = 2.95) or 'deterioration in functioning' (OR = 3.31) trajectories versus the 'high functioning' trajectory, or 'delayed response general psychopathology' trajectory (OR = 3.63) or 'slower response and no response general psychopathology' trajectory (OR = 1.71), as compared to the 'early response and stable general psychopathology' trajectory.

### 3.2. Analysis for change in vocational status

Out of the 530 who were first unemployed at baseline, 221 (41.7%) remained unemployed and 309 (58.3%) returned to education or employment at the end of two years, whereas out of the 647 who were first meaningfully employed at baseline, 520 (80.4%) remained employed and 127 (19.6%) ended up being unemployed. A multinomial logistic regression was conducted with four outcome levels – unemployed at baseline and unemployed at end of two years, unemployed at baseline but meaningfully employed at end of two years,

meaningfully employed at baseline and meaningfully employed at end of two years, and meaningfully employed at baseline but unemployed at end of two years. The results revealed that while controlling for all other factors, as compared to those who were meaningfully employed at baseline and meaningfully employed at end of two years, those who were meaningfully employed at baseline but ended up being unemployed at end of two years were more likely to be Malay instead of Chinese (OR = 1.80,  $p$ -value = 0.048), separated from their partner versus single and never married (OR = 4.57,  $p$ -value = 0.008), have a higher PANSS negative score at baseline (OR = 1.06,  $p$ -value = 0.003), belong to the 'delayed response general psychopathology' trajectory (OR = 5.49,  $p$ -value = 0.014) than the 'early response and stable general psychopathology' trajectory, and belong to the 'moderately stable functioning' trajectory (OR = 3.10,  $p$ -value < 0.001) or 'deterioration in functioning' trajectory (OR = 3.56,  $p$ -value = 0.037) instead of the 'high functioning' trajectory.

### 4. Discussion

Out of the 1177 participants who were included for the analysis, 829 (70.4%) were meaningfully engaged in an age-appropriate role at the end of two years of intervention. A review by Marwaha and Johnson (2004) found that rates of employment of people with schizophrenia ranged from 4% to 27% in the UK, 8% to 35% in Europe, and 3% to 43% in the US, while rates of employment of people with first-episode psychosis ranged from 13% to 65% internationally. At 70.4%, the rate reported in our study was comparable to but slightly higher than the three-year outcome employment rate of 64.3% in an early intervention for first-episode psychosis program in Hong Kong (Chen et al., 2011). This could possibly be due to the less stringent time criteria in our study (three months instead of six), or the inclusion of the students and homemakers subpopulation in our study. Specific to our sample, the possible impact of heterogeneity due to the different psychotic conditions in our sample inflating the employment rate in our study had been ruled out, with the employment rate and predictors of unemployment at the end of two years not significantly different after repeating all analyses excluding subjects with affective psychosis, brief psychotic disorder, or psychotic disorder not otherwise specified. However, this result needs to be replicated in future studies. As previous research in this population has confirmed the association between well-being and being meaningfully employed (Tan et al., 2019) and a review by Rinaldi et al. (2010) reported that early interventions for first-episode psychosis are able to better prevent functional decline as compared to community mental health teams, the rate in the present study is encouraging and strengthens the evidence for effectiveness of early interventions. Sociodemographic risk factors for being unemployed at the end of two years include being Malay, single, and unemployed at baseline. Clinical factors that were significant in our study in predicting unemployment included having a longer DUP and a diagnosis of schizophrenia, schizophreniform, or delusional disorder at baseline, which have been associated with having a poorer prognosis in the long-term (Chong et al., 2005). In addition, those who were unemployed at the end of two years tended to have 'delayed response' or 'slower response and no response' to treatment in terms of general psychopathology symptoms, while there was no significant effect of the positive and negative symptom trajectories. As the PANSS general psychopathology subscale captures aspects such as mood and cognition, it seems plausible that post-psychotic depression and one's ability to cope with the psychotic episode may have a negative impact on vocational outcomes. Further research will be needed to explore this.

However, 19.6% of patients who were first meaningfully employed at baseline did end up unemployed at the end two years. While this group constitutes a relatively smaller percentage, it is still substantial enough to be of concern. Our supplementary analysis provided some preliminary insight into this. The loss of occupation at the end of two years was associated with higher PANSS negative scores at baseline,

which is consistent with previous research (Fusar-Poli et al., 2015; Ventura et al., 2009). In terms of general psychopathology symptom trajectories, only the 'delayed response general psychopathology' trajectory remained a significant factor in predicting loss of employment. It is possible that this group signifies the presence of a small but at-risk group for losing employment among those who were capable of engaging in a meaningful role in the first place. In conclusion, with our findings on the clinico-demographic predictors, patients who are at risk of not being employed or losing employment can be identified early and monitored closely to alleviate potential psychological and financial consequences, and actively targeted for vocational rehabilitation or supported employment (Rinaldi et al., 2010).

As hypothesized, the logistic regression model which included trajectories instead of baseline clinical factors was able to better predict 2-year vocational outcomes in our sample. This is likely because the symptom and functioning trajectories contain more information and is therefore more sensitive to enduring patient characteristics than single-point data. Comparatively, the same baseline sociodemographic characteristics are still significantly predictive for both models; however, the PANSS general psychopathology and GAF trajectories were significant in predicting unemployment at 2-year timepoint but not the single-point baseline scores of the two measures, while the PANSS negative single-point baseline score was a significant predictor of unemployment but not the symptom trajectory. This highlights the importance of studying PANSS and GAF patterns over time, which can provide an incrementally comprehensive picture of patient characteristics affecting treatment outcomes.

To the best of the authors' knowledge, Abdin et al.'s (2017) original paper was the first Asian study examining symptom and functioning trajectories in a sample of first-episode psychosis patients. The present study is the first paper to look at using symptom and functioning trajectories in predicting vocational outcomes at the end of two years. Furthermore, our study has a large sample size and a relatively acceptable proportion of missing data (18.9%), and our database is maintained systematically and subject to stringent checks, with high inter-rater reliability rates among the clinicians. However, while we have confirmed patient clinico-demographic characteristics that are of importance to note in optimizing treatment strategies in our sample, there remain a few limitations for this study. Other than the missing data, this study also did not include other treatment factors, such as medication algorithms or cognitive interventions that could have potential effects on symptom or functioning trajectories, and in turn, vocational outcomes. It is imperative for future studies to look into the incremental validity of taking these factors into account. In addition, as intermediate factors such as social support, engagement with treatment team, or patients' insight into their illness may be involved in the pathway between clinical symptoms and vocational outcomes, moderating and mediating analyses should also be conducted upon confirmation of all known predictive factors, to examine in detail the interactions between patient and treatment factors, which will in turn guide tailoring of treatment protocols specific to patient groups. For one, it would be important to look into the group of patients with a 'delayed response general psychopathology' or 'slower response and no response general psychopathology' symptom trajectory and investigate if there are other constructs comprising the pathway that are impeding their efforts in seeking employment. Another possible limitation stems from the dichotomization of the dependent outcome as meaningfully employed and unemployed, instead of considering vocational outcomes as a range across several levels of engagement, which is often age-dependent. As majority of homemakers and National Servicemen are older females and younger males respectively, there may be possible overlaps that contribute to the over- and under-inflation of vocational outcomes among the female and male populations specifically. In addition, the onset of a psychotic disorder leading to vocational disruption may result in underemployment or economically inadequate employment (Dooley, 2003), an issue which was not assessed in the present study but could be of

importance especially to youths without prior employment history. To circumvent this potential loss of information due to the dichotomization of the dependent outcome, future works could recruit a greater sample size, or utilize a quota-based sampling method, to obtain an even distribution across different levels of employment. Such methods could also allow for stratification of results according to stable parameters such as gender, which was not possible in the current study as the results derived from the logistic regression models would not be stable due to the low number of cases in certain symptom and functioning trajectories when correlating with the outcome variable. Lastly, the categorized vocational outcomes should also not be used as a sole definitive indicator of treatment outcomes. In line with the recovery movement (Anthony, 1993), a patient-centered approach on what constitutes a good outcome is also significant to provide a well-rounded perspective on evaluation of treatment efforts.

The onset of a psychotic disorder is linked to high personal and societal costs. Early intervention programs have been designed for comprehensive and holistic treatment during the initial critical phase of the disorder, to maximize positive outcomes, such as quality of life, and reduce negative consequences, such as loss of employment (Chong et al., 2001). There is evidence for the effectiveness of individual placement and support (Killackey et al., 2019), supported employment (Rosenheck et al., 2016), and vocational case management (Abdel-Baki et al., 2013) on vocational outcomes in patients with first-episode psychosis. Patients who are more likely to remain unemployed or lose employment should therefore be identified as early as possible and considered for such specialized interventions, in line with our collective efforts to improve service user outcomes timely and effectively. Future studies employing evidence-based employment-focused interventions delivered as part of the first-episode psychosis program must be considered across multiple sites and outcomes monitored both over the period of the program and long-term to gain a better understanding of the interplay between employment and well-being of patients. As the present study was conducted in an early intervention program for first-episode psychosis, the results will be of use to guide clinical practices across other similar international services.

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#### Contributors

Author YC undertook the statistical analysis and wrote the first draft of the manuscript. Author EA designed the primary study, wrote the protocol, and supervised the statistical analysis. Author CT supervised the writing of the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

#### Data Availability Statement

All individual data from this study resides with Office of Research, Institute of Mental Health. Data is not available for online access, however readers who wish to gain access to the data can write to the Clinical Research Committee, Institute of Mental Health/Woodbridge Hospital Secretariat at [IMHRESEARCH@imh.com.sg](mailto:IMHRESEARCH@imh.com.sg). Access can be granted subject to the Institutional Review Board (IRB) and the research collaborative agreement guidelines. This is a requirement mandated for this research study by our IRB and funders.

#### Declaration of Competing Interest

All authors declare that they have no conflicts of interest.

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