A systematic review and meta-analysis of the effect of transitional care interventions on the prognosis of patients with heart failure

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Background: The purpose of this study was to explore the impact of transitional care interventions on the prognosis of patients with heart failure.

Methods: Literature on transitional care interventions in patients with heart failure were retrieved from PubMed, Medline, Embase, and CENTRAL databases. The literature retrieval date was October 12, 2021. The inclusion criteria were based on PICOS principles. A researcher independently extracted information from the literature included in the meta-analysis, including author, title, publication date, patient baseline information, intervention measures, and observation indicators. Two other researchers checked the extracted data. Cochrane bias risk assessment was used to evaluate the quality of the included study. The chi-square test was used for heterogeneity test. Egger test was used for publication bias test. Data were statistically analyzed using Cochrane software RevMan 5.3. The Chi-square test was used to assess heterogeneity. The odds ratio (OR) and 95% confidence interval (CI) were used to describe the count data statistically.

Results: A total of 567 related articles were retrieved, and 18 studies were further screened for meta-analysis, 13 with low risk of overall bias, and 5 with high risk of overall bias. A total of 4,123 patients with heart failure were included, comprising 1,914 patients receiving transitional care interventions (46.42%) and 2,209 patients receiving routine care interventions (53.58%). The readmission rate of heart failure in patients receiving transitional care interventions was lower than that of patients receiving routine care interventions. There was heterogeneity among the literatures, and the source analysis of heterogeneity showed that the results were stable, and the random effect model was adopted without publication bias. The emergency visit rate of patients with heart failure receiving transitional care interventions was lower than that of patients receiving usual care interventions. There was no significant difference in mortality between patients receiving transitional care interventions and patients receiving usual care interventions.

Discussion: Transitional care interventions can reduce the rate of patient readmission and emergency visits but have no significant impact on the mortality of patients. This study suggests the establishment of a transitional care intervention system for patients with heart failure

Keywords: Transitional care; usual care; heart failure; prognosis; meta-analysis

Introduction

Most cardiovascular-related diseases eventually turn into heart failure (1). The incidence rate and mortality of heart failure are increasing due to the acceleration of the ageing process (2). The treatment of this disease requires enormous medical resources, resulting in a corresponding economic burden. Patients with heart failure need complex treatment schemes and long-term follow-up strategies (2). A previous study had demonstrated that 20% of patients with heart failure are re-hospitalized within 1 month after discharge, while the proportion is as high as 34% within 3 months after discharge (3). Heart failure, unlike other diseases, has a higher rate of readmissions. However, lack of self-management awareness, weak family support, and lack of knowledge of the early symptoms of disease monitoring all negatively impact the prognosis of patients with heart failure, especially repeated hospitalization (4).

Transitional care usually refers to the continuation from hospital to family, including the discharge plan, referral, and constant follow-up and guidance after patients return to family or community, which can fill the missing section of nursing intervention from hospital to family. The main goal of transitional care is to promote the rehabilitation of patients and reduce the need for rehospitalization due to the deterioration of their condition (5). Transitional nursing intervention on patients with heart failure has been controversial, especially in all-cause readmission rates, emergency visit rates, emergency admission rates and mortality. However, the results of different studies deviate from each other. A previous study had shown that transitional care only reduces the heart failure-specific readmission rate (4). At present, there is a lack of solid evidence to confirm the positive impact of transitional care on patients with heart failure. Therefore, this study conducted a meta-analysis to explore the impact of transitional nursing on the prognosis of patients with heart failure and provide a reference basis for clinical decision-making. We present the following article in accordance with the PRISMA reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-22-102/rc).

Methods

Literature retrieval

Literature searches were conducted in PubMed, MEDLINE, Embase, and CENTRAL databases. The search terms were: ("transitional care" or "extended care" or "hospital-to-home intervention" or "continuity of care") and ("heart failure" or "cardiac failure"). The date of literature search was October 12, 2021.

Literature screening

The inclusion criteria refer to PICOS principles: (I) The subjects were patients with heart failure; (II) In the study, the experimental group implemented continuous care (TC), and the control group implemented routine care (UC). Transitional nursing intervention refers to the implementation of continuous nursing intervention for patients from hospital to family, led by nurses, including discharge plan formulated by the hospital, continuous follow-up and guidance after patients return to family or community; Routine nursing refers to receiving nursing intervention during hospitalization and no nursing intervention after discharge; (III) the observation indicators included readmission rate, emergency visit rate, and mortality of patients with heart failure; (IV) The study type was an RCT; (V) the statistical data in the literature could calculate the odds ratio (OR) and 95% confidence interval (CI); (VI) The time interval of literature publication is after January 2000. The exclusion criteria were as follows: (I) The literature had research design defects or statistical method errors that could not be corrected. The error evaluation of Statistical Methods refers to common statistical errors (6); (II) the main content of the literature was not in line with the research direction of this paper; (III) the specific scheme of transitional nursing intervention was not described; (IV) the subjects had no clear diagnostic criteria; (V) in addition to nursing intervention, the subjects also received other intervention measures affecting the research results; (VI) the baseline data of the control group and the experimental group were poorly balanced; (VII) the data was incomplete and could not be supplemented by contacting the author.

Literature data sorting

A researcher independently extracted the data of the included literature, including the author, title, publication time, patient baseline data, intervention measures, and observation indicators. Two other researchers checked the extracted data and information. When there were different opinions on literature data extraction, the 3 researchers discussed and resolved any differences.

Literature quality evaluation

In this paper, three researchers used Cochrane bias risk assessment to evaluate the quality of the literature included in the study. The literature quality can be divided into three categories: low overall bias risk, high overall bias risk and unknown bias risk. The researchers independently evaluated the literature quality. In case of inconsistency in the judgment results of literature quality, the results agreed by researchers after discussion shall be adopted.

Heterogeneity test and publication bias test

The Chi-square test was used to assess heterogeneity. When I^2 corrected by degrees of freedom was more than 50% and P<0.1, this indicated heterogeneity among the literature. Subgroup analysis was used to explore the causes of heterogeneity. When $I^2 \leq 50\%$ and $P \geq 0.1$ after degrees of freedom correction, there was no heterogeneity among the literature. Egger test was used to examine the publication bias.

Heterogeneity source analysis

Suppose there was heterogeneity among the literature after excluding the low-quality literatures. In that case, the heterogeneity test was carried out again, and the combined analysis model was selected according to the test results. If the results did not change significantly, indicating that the sensitivity was low and the results were credible. If there was a clear and significant change in the source of the intervention, suggesting that there was a significant change in the potential effect of the intervention. If there was a significant change in the source of the intervention, it indicates a significant change in the potential impact of the intervention.

Effect model selection and forest map drawing

According to the results of the heterogeneity test and heterogeneity source analysis, the merger effect model was selected. There was no heterogeneity among the studies finally included in the analysis, and the fixed effect model was used. Finally, there was heterogeneity among the studies included in the analysis, and the reason for the heterogeneity is not found. Therefore, the random effect model was used. The summary effect results were displayed in the form of forest map.

Statistical analysis

Data were statistically analyzed by Cochrane software RevMan 5.3. OR value and 95% CI were used to describe the count data. P<0.05 indicated that the difference was statistically significant.

Results

Retrieval results and literature quality evaluation

Based on the relevant subject words, 1,017 studies related to the prognosis of heart failure after transitional care intervention were retrieved. According to the literature screening criteria, this study further screened 18 studies for meta-analysis (7-24). The flow chart of literature screening is shown in *Figure 1*. A total of 4,123 patients with heart failure were included in the 18 studies, comprising 1,914 (46.42%) patients receiving the transitional nursing intervention and 2,209 (53.58%) patients receiving the routine nursing intervention. The patients' clinical information is shown in *Table 1*. Among the 18 articles, 13 articles showed an overall low risk of bias and 5 articles showed an overall high risk of bias.

Effect of transitional care interventions on the readmission rate

Among the 18 studies, 11 investigated the effect of transitional care interventions on the readmission rate of patients with heart failure, including 1,118 patients receiving transitional nursing and 1,386 patients receiving routine nursing. There was heterogeneity among the 11 studies (χ^2=41.75, P<0.00001, I^2=76%). The analysis of heterogeneity sources indicated that the results were robust and the source of heterogeneity was unknown, thus the random effect model was used. The combined effect amount OR =0.63 (95% CI: 0.53, 0.76), and the test of overall effect Z=5.07 (P<0.00001), as shown in *Figure 2*. The analysis showed that the readmission rate of patients with heart failure receiving transitional care was lower than that in patients receiving routine care. The funnel plot showed that the data points were distributed on both sides, within the confidence interval, and were roughly symmetrical, indicating no obvious publication bias, as shown in *Figure 3*.
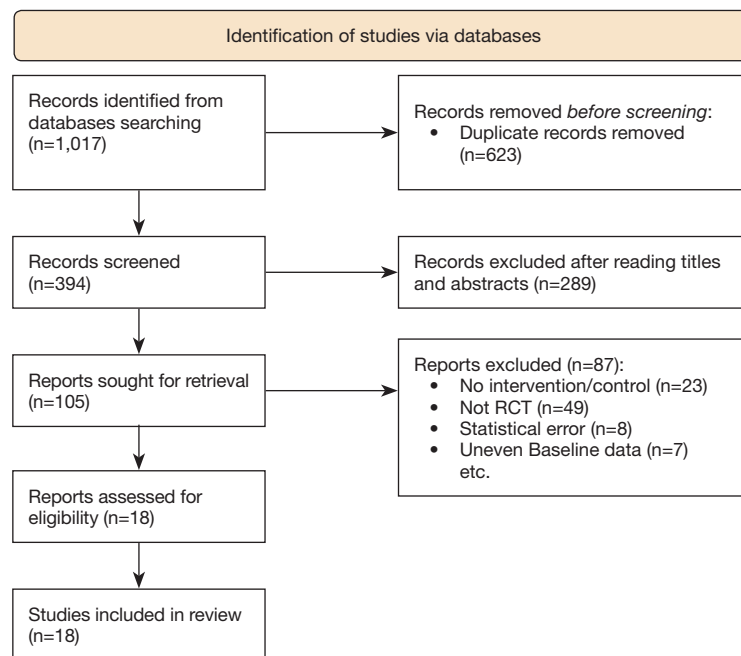
Figure 1 Flow chart of literature screening.

Table 1 Clinical baseline information of all the included patients

Study	Study design	No. of patients		Readmission		Emergency visit		Mortality cases	
		TC	UC	TC	UC	TC	UC	TC	UC
Anderson *et al.* (10), 2005	RCT	44	77	5	34	–	–	–	–
Angermann *et al.* (18), 2012	RCT	352	363	119	112	–	–	–	–
Atienza *et al*. (19), 2004	RCT	164	174	–	–	–	–	39	51
Bowles *et al.* (8), 2011	RCT	101	116	23	26	–	–	–	–
Blue *et al.* (22), 2001	RCT	84	81	–	–	–	–	25	25
Domingues *et al.* (11), 2011	RCT	48	63	20	23	4	8	–	–
Ducharme *et al.* (16), 2005	RCT	115	115	–	–	69	72	–	–
Harrison *et al.* (21), 2002	RCT	80	77	–	–	23	35	–	–
Kulshreshtha *et al.* (24), 2010	RCT	114	139	–	–	22	34	–	–
Kwok *et al.* (7), 2008	RCT	49	56	23	32	–	–	–	–
Lee *et al.* (20), 2019	RCT	159	329	18	103	3	36	–	–
Naylor *et al.* (23), 2004	RCT	118	121	45	61	–	–	11	13
Nucifora *et al.* (17), 2006	RCT	99	101	–	–	–	–	14	8
Stauffer *et al.* (13), 2011	RCT	56	84	5	12	1	6	–	–
Thompson *et al.* (14), 2005	RCT	58	48	13	21	–	–	–	–
Tsuyuki *et al.* (9), 2004	RCT	140	136	–	–	41	69	–	–
Wong *et al.* (15), 2016	RCT	43	41	14	25	–	–	3	6
Yu *et al.* (12), 2015	RCT	90	88	19	39	6	14	2	6

TC, transitional care; UC, usual care.

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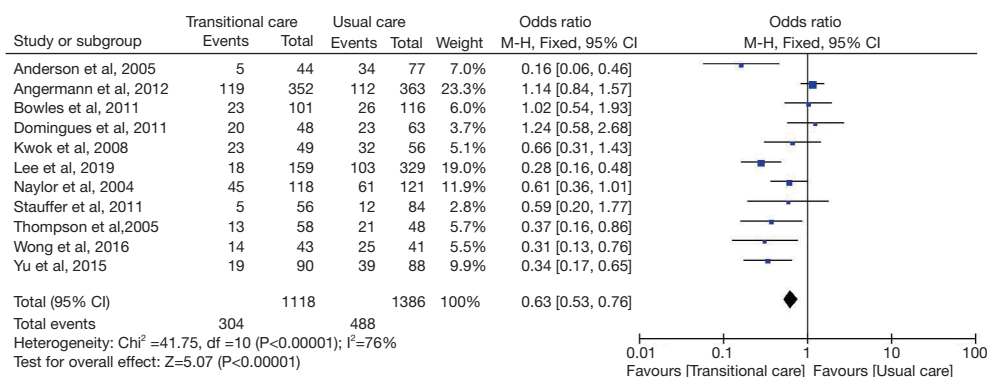**Lin et al. Transitional care in patients with heart failure**

Figure 2 Forest plot of the effect of transitional care intervention on the readmission rate of patients with heart failure. CI, confidence interval.
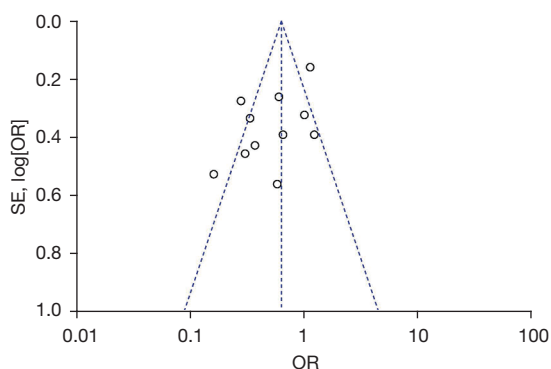

Figure 3 Funnel plot of the effect of transitional care intervention on the readmission rate of patients with heart failure. OR, odds ratio.

Effect of transitional care interventions on the emergency visit rate

Eight of the 18 studies investigated the effect of transitional care interventions on the emergency visit rate of patients with heart failure, including 802 patients who received transitional nursing and 1,031 patients who received routine nursing. There was no heterogeneity among studies (χ^2=11.35, P=0.12, I^2=38%), and the fixed effect model was used. The combined effect amount OR =0.51 (95% CI: 0.40, 0.66), and the test of overall effect Z=5.22 (P<0.00001), as shown in *Figure 4*. The analysis showed that the emergency visit rate of heart failure patients receiving transitional care was lower than that of patients receiving routine care. The funnel plot showed that the data points were distributed on both sides, within the confidence interval, and were roughly symmetrical, indicating no obvious publication bias, as shown in *Figure 5*.

Effect of transitional care interventions on mortality

Six of the 18 studies investigated the effect of transitional care interventions on the mortality of patients with heart failure, including 661 patients who received transitional nursing and 606 patients who received routine nursing. There was no heterogeneity among the 6 studies (χ^2=6.61, P=0.25, I^2=24%), and the fixed effect model was used. The combined effect amount OR =0.80 (95% CI: 0.58, 1.09), and the test of overall effect Z=1.43 (P=0.15), as shown in *Figure 6*. The analysis showed that there was no significant difference in mortality between patients with heart failure receiving transitional care and patients receiving routine care. The funnel plot showed that the points were distributed on both sides, within the confidence interval, and were roughly symmetrical, indicating no obvious publication bias, as shown in *Figure 7*.

Discussion

There is no unified standard for the clinical care intervention of patients with heart failure. A previous study believed that transitional care intervention and self-management of heart failure can significantly improve the prognosis of patients (7). Therefore, to provide a reference basis for the care intervention of patients with heart failure, this study comprehensively included relevant literature for meta-analysis. The convenience of transitional care intervention and the corresponding clinical efficacy have been improved in recent years. Therefore, we searched the literature on the impact of transitional care interventions on the prognosis of patients with heart failure after 2000. The time limit of this study is significantly different from other
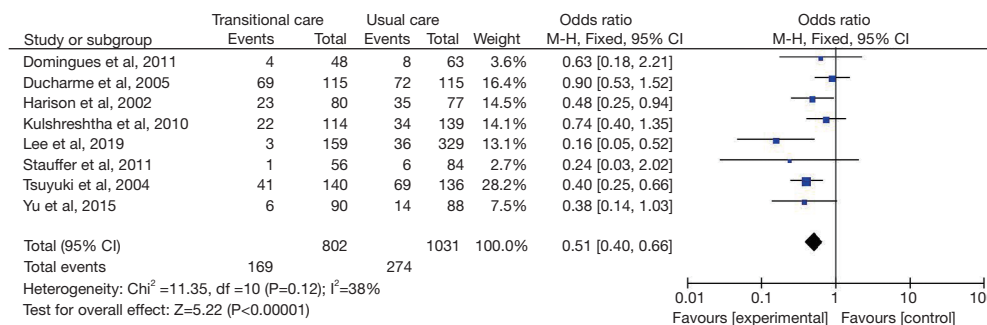
Study or subgroup	Transitional care Events	Total	Usual care Events	Total	Weight	Odds ratio M-H, Fixed, 95% CI
Domingues et al, 2011	4	48	8	63	3.6%	0.63 [0.18, 2.21]
Ducharme et al, 2005	69	115	72	115	16.4%	0.90 [0.53, 1.52]
Harison et al, 2002	23	80	35	77	14.5%	0.48 [0.25, 0.94]
Kulshreshtha et al, 2010	22	114	34	139	14.1%	0.74 [0.40, 1.35]
Lee et al, 2019	3	159	36	329	13.1%	0.16 [0.05, 0.52]
Stauffer et al, 2011	1	56	6	84	2.7%	0.24 [0.03, 2.02]
Tsuyuki et al, 2004	41	140	69	136	28.2%	0.40 [0.25, 0.66]
Yu et al, 2015	6	90	14	88	7.5%	0.38 [0.14, 1.03]
Total (95% CI)		802		1031	100.0%	0.51 [0.40, 0.66]
Total events	169		274			

Heterogeneity: Chi^2 =11.35, df =10 (P=0.12); I^2=38%
Test for overall effect: Z=5.22 (P<0.00001)

Figure 4 Forest plot of the impact of transitional care intervention on the emergency visit rate of patients with heart failure. CI, confidence interval.
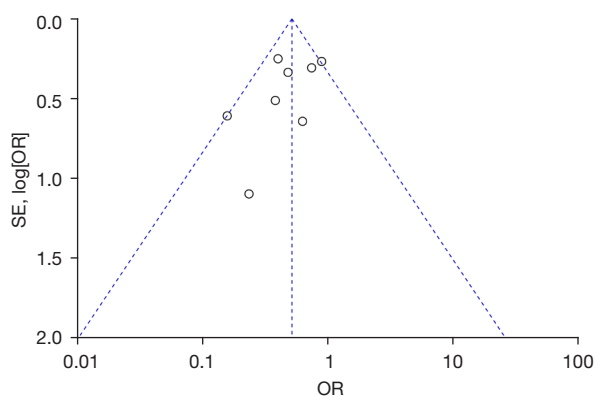

Figure 5 Funnel plot of the impact of transitional care intervention on the emergency visit rate of patients with heart failure. OR, odds ratio.

similar studies. The primary etiology of heart failure is complex and diverse. Our research does not focus on heart failure caused by a specific disease but includes relevant studies on multidisciplinary heart failure for comprehensive analysis.

We found that transitional care intervention can reduce the readmission rate and emergency visit rate, but it has no significant effect on the mortality of patients. A study had pointed out that patients with chronic heart failure lack a reasonable self-management scheme and a well-established family expenditure system after discharge (3). Thus, their condition cannot be effectively controlled. Over a short period, their condition will worsen again, further leading to an increase in the number of readmissions. Proper and timely transitional care intervention can solve this problem. Transitional care intervention can help patients control exacerbation factors and improve their ability to identify the early symptoms of heart failure deterioration. Therefore, when the early signs of heart failure occur, they can receive treatments in time.

However, the differences in the specific measures of transitional care intervention in this study should be noted, including disease-related education for patients and their families, formulation of a personalized nursing plan at discharge, and follow-up after discharge. Feltner *et al.* also conducted relevant research in which they specifically compared the effects of different transitional intervention strategies on the readmission rate of patients with multidisciplinary heart failure (25). The home visit program reduced all-cause readmissions and heart failure-specific readmissions. Structured telephone support intervention can reduce heart failure-specific readmission but cannot reduce all-cause readmission (25). A study also pointed out that the readmission rate of patients with heart failure is related to the follow-up time and frequency of transitional care intervention. The higher the follow-up frequency and the longer the follow-up duration, the lower the readmission rate (20). A study had confirmed that transitional care can reduce the all-cause readmission rate of patients and reduce the readmission rate of patients with heart failure (11).

A study had investigated mortality stratified by type of transitional care intervention and time of outcome. Compared with routine care, home visit intervention reduced mortality (14). Remote monitoring and major educational interventions did not reduce mortality. However, in our study, we did not find that transitional intervention significantly impacted the mortality of patients with heart failure. The results may be related to the insufficient inclusion of time factors in the literature we analyzed. A study had pointed out that the 3-year survival rate of heart failure patients with transitional care intervention is higher than that of patients with routine care (22).

It is worth noting that in some current studies, the leaders of transitional care intervention are not nurses but pharmacists. A study had shown that transitional care
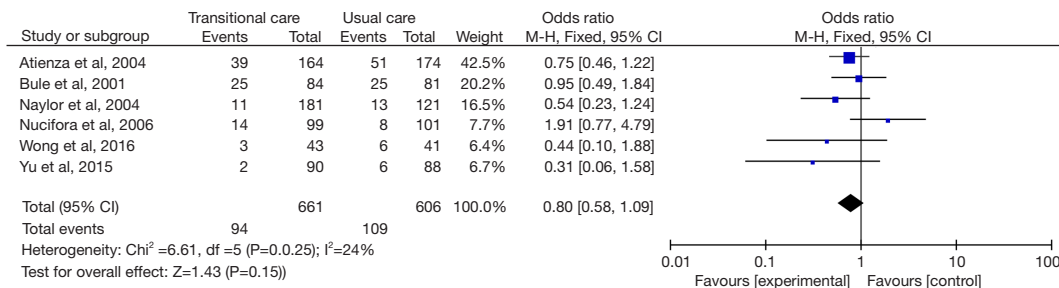
Figure 6 Forest plot of the effect of transitional care intervention on the mortality of patients with heart failure. CI, confidence interval.
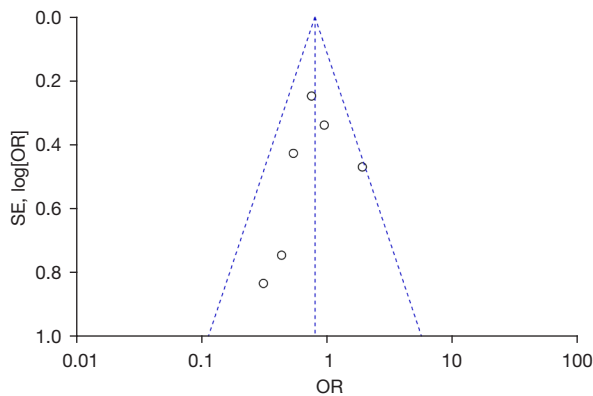

Figure 7 Funnel plot of the effect of transitional care intervention on the mortality of patients with heart failure. OR, odds ratio.

intervention led by pharmacists can reduce the 30-day all-cause readmission rate of patients with congestive heart failure. However, the cost-benefit comparison results are not clear (26).

In conclusion, our study shows that transitional care intervention can reduce the readmission rate and emergency visit rate, but has no significant effect on the mortality of patients. This study suggests establishing a transitional care intervention system for patients with heart failure.

Acknowledgments

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-22-102/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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