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Effects of multidisciplinary team on emergency care for colorectal cancer patients

A nationwide-matched cohort study

Chun-Ming Liao, MS[a,b], Pei-Tseng Kung, ScD[c], Yueh-Hsin Wang, MHA[d], Wen-Chen Tsai, DrPH[d,*]

Abstract

The literature describing the effectiveness of multidisciplinary team (MDT) for the care of colorectal cancer remains unclear. We investigated the effects of MDT care on the quality of colorectal cancer treatment, and the emergency department visit number was used as an indicator. In total, 45,418 patients newly diagnosed with colorectal cancer from the Taiwan National Health Insurance Research Database (2005–2009) were included. Propensity score matching with a ratio of 1:3 was adopted to reduce differences in characteristics between MDT care participants and non-MDT care participants. After matching, 3039 participation MDT care groups and 9117 nonparticipation groups were included and analyzed with χ^2 and t tests, determine the distribution was similar. Without the control of variables, the percentage difference between participation and nonparticipation MDT care groups in utilization of emergency care was 0.03% ($P > .05$). The logistic regression model involving controlled variables demonstrated that odds ratio (OR) by probability of emergency care used for participation MDT care groups within a year of cancer diagnosis was less than that for nonparticipation (OR = 0.87, 95% confidence interval: 0.78–0.96). Large amount data were used and confirmed significant benefits of MDT in colorectal cancer care.

Abbreviations: ANOVA = analysis of variance, CCI = Charlson Comorbidity Index, CI = confidence interval, MDT = multidisciplinary team, NCCN = National Comprehensive Cancer Network, NHIRD = National Health Insurance Research Database, OR = odds ratio, PSM = propensity score matching.

Keywords: cancer care, cohort study, colorectal cancer, emergency visit, multidisciplinary team

1. Introduction

Colorectal cancer remains one of the most highly prevalent diseases worldwide.[1] In Taiwan, the incidence rate of colorectal cancer has been the highest among diseases common for both sexes for many years. In total, 14,040 persons were diagnosed with colorectal cancer (age-standardized incidence rate per 100,000 persons was 45.3) in 2011 alone.[2] From 1995 the earliest implementation of the United Kingdom to the present,[3] many countries used "multidisciplinary team" (MDT) model to do a better job of cancer treatment and care.[4,5] MDT has been implemented by the Health Promotion Administration in Taiwan since 2004, and provides integration and continuity of cancer diagnosis, treatment, and care from physician, surgeons, pathologists, and nurse in accordance with "Regulations for Cancer Care Quality Assurance Measures."[6] It also includes psychological counseling, social worker service, spiritual care, cancer care, pain control, nutrition, health education and medication counseling, rehabilitation, discharge planning, hospice or home care service, and patient support group information.

In fact, many studies have mentioned that a MDT contributes to a better clinical manifestation of colorectal cancer treatments such as early detection and early treatment,[7] the standardization of treatment guidelines,[8] and the correct computed tomography (CT) and magnetic resonance imaging (MRI) examination methods[9] and will improve the survival rate of patients with colorectal cancer.[10,11] Moreover, several studies stated that it had better clinical outcomes in use of MDT in the treatment of other cancer areas such as lung cancer,[12,13] oral cavity cancer,[14,15] hepatocellular carcinoma,[16] and esophageal cancer.[17] However, 1 systematic review study included 27 articles with a comparison group of MDT and pointed out that MDT improvement in the effectiveness of treatment including colorectal cancer treatments was limited.[5] Another systematic review study of breast cancer has similar conclusion that there are a paucity of evidences to support MDT care being associated with better survival.[18] Current studies on MDT have yet to reach consensus that requires further in-depth discussion.

It is mentioned in the National Comprehensive Cancer Network (NCCN, Fort Washington, PA) and many colorectal cancer care guidelines[19] that patients after any cancer treatments should immediately seek care for medical emergencies such as fever, severe diarrhoea or vomiting, shortness of breath, and

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[a] Department of Public Health, China Medical University, [b] Department of Pharmacy, China Medical University Hospital, [c] Department of Healthcare Administration, Asia University, [d] Department of Health Services Administration, China Medical University, Taichung, Taiwan.

[*] Correspondence: Wen-Chen Tsai, Department of Health Services Administration, China Medical University, 91 Hsueh-Shih Road, Taichung 40402, Taiwan (e-mail: wtsai@mail.cmu.edu.tw).

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bleeding. In clinical, studies have found that the poor quality of cancer treatment will result in more emergency care visits.[12,20] Other studies have also demonstrated that a monitoring mechanism should be established to ensure the quality of treatment for colorectal cancer and the number of emergency care visits.[21,22] More studies have shown that emergency care is the classic indicator related to poor postoperative cancer care.[8,23] In fact, clinical statistics related to emergency care have shown that 0.9% of emergency department visits were cancer-related diseases in the United States, of which 7.7% of visits were colorectal cancer.[22] In Taiwan, the percentage was as high as 1.9% (>0.9, in the USA) of emergency department visits related to cancers.[24]

From the above mentioned literature reviews, we found that there are different perspectives and discussions on the effects of MDT on the improvement of the quality of cancer care. In particular, literature discussion on the effectiveness of MDT in the treatment of colorectal cancer is limited, and studies generally have insufficient evidence to support data analysis (eg, no representative samples or without a comparison group of MDT).[5] Therefore, the aim of this study was to investigate the influence of MDT on the quality of treatment of colorectal cancer, and the number of emergency care visits was used as an indicator to enrich MDT literature and provide clinical reference for colorectal cancer treatment.

2. Materials and methods

2.1. Data sources

This study used 3 secondary datasets. The "Taiwan Cancer Registry" from 2005 to 2009 published by the Taiwan Health Promotion Administration is used as the source of study subjects that along with the "National Health Insurance Research Database" (NHIRD) from 2002 to 2010, provided by Taiwan Ministry of Health and Welfare, was applied to analyze the health status of the study subjects before and after diagnosed cancer, use of medical resources, cancer treatments, and characteristics of cancer patients judged at that time. Furthermore, "Cause of Death Data" from 2005 to 2010 was used to determine subject death. In December 2009, 23,026,000 persons were insured,[24] constituting 99.59% of the population in Taiwan (23,120,000 persons); therefore, this is representative research data for Taiwan.

2.2. Subjects

In this study, 45,418 patients with newly diagnosed colorectal cancer (ICD-9-CM code: 153.x, 154.x, A093, A094) from 2005 to 2009 were included in the study. Twenty-four patients who died within a month of confirmed diagnosis, 4402 patients who did not receive active treatment (surgery, chemotherapy, radiation therapy, or others) within a year, 41 patients who received palliative care or received treatment at medical institutions other than a hospital and 16,709 patients who had incomplete information such as demographic profile or cancer staging were excluded. At the end, there were 24,242 people being enrolled (Fig. 1). This study was approved by China Medical University Hospital (IRB No.CMUH102-REC3–076).

2.3. Variable description and definition

Because the purpose of this study was to investigate the effect of MDT care on the use of emergency care by colorectal cancer patients, the independent variable was the MDT care participation status (participation/nonparticipation). Dependent variables included whether the patient used emergency care or not and the utilization of emergency care within a year of cancer diagnosis, whereas noncancer visits were excluded. We also included 14 controlled variables[11,12] such as demographic characteristics (sex, age), socioeconomic status (monthly salary), environmental factor (urbanization level of residence area), health condition (Charlson Comorbidity Index [CCI], catastrophic illness/injure, number of outpatient visit, number of inpatient visit), cancer

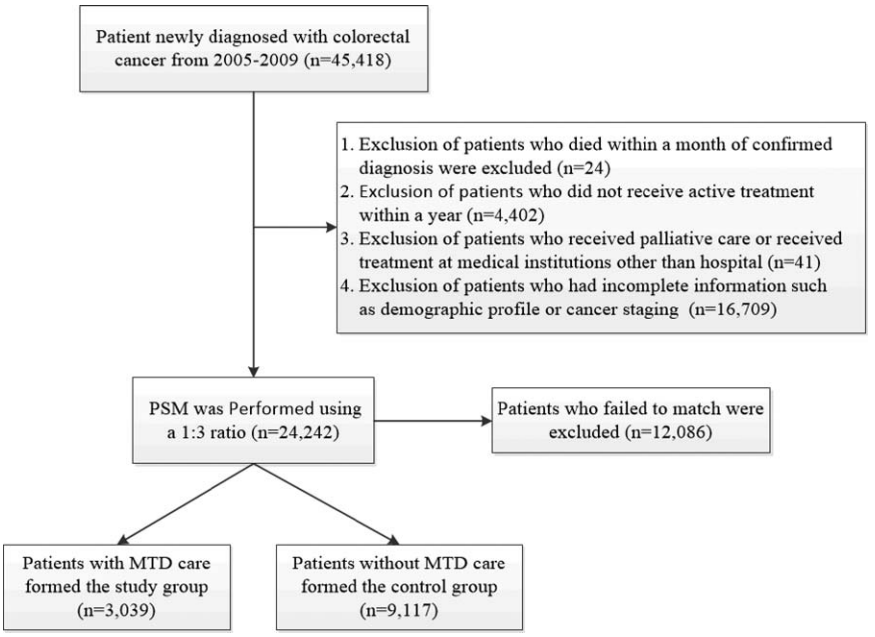

Figure 1. Subjects recruited flowchart.

Table 1

Operational definition of variables and data sources.

Variables	Operational	Data sources
Dependent variable		
Emergency care utilization	Used/ not used Number of visit	NHIRD
Independent variable		
MDT participation	MDT (Yes)/non-MDT (No)	NHIRD
Controlled variables		
Sex	Female/Male	Taiwan Cancer Registry
Age, y	≦44, 45–54, 55–64, 65–74,≧75	Taiwan Cancer Registry
Monthly salary, NT$	Low-income, 1–17,280, 17,281–22,800, ≧22,801	NHIRD
Urbanization level of residence area	1, 2 & 3, 4 & 5, 6 & 7	NHIRD
CCI	0–3, 4–6, 7–9, ≥10	NHIRD
Catastrophic illness/injury	Yes/ No	NHIRD
Cancer staging	I, II, III, IV	Taiwan Cancer Registry
Therapy	Surgery (OP) only; radiation therapy (RT) only; chemotherapy (CH) only; OP + RT; OP + CH; RT + CH; OP + RT + CH	Taiwan Cancer Registry
Hospital level	Medical center; Regional hospital; District hospital	Taiwan Cancer Registry and NHIRD
Hospital ownership	Public/private	Taiwan Cancer Registry and NHIRD
Service volume of hospital	Low (<25%), middle (25–75%), high (>75%)	Taiwan Cancer Registry and NHIRD
Service volume of physician	Low (<25%), middle (25–75%), high (>75%)	NHIRD
Outpatient visits	0–5, 6–10, 11–15, 16–20, 21–25,≧26	NHIRD
Inpatient visits	0, 1, 2,≧3	NHIRD

CCI = Charlson Comorbidity Index, MDT = multidisciplinary team care, NHIRD = National Health Insurance Research Database, NT$ = new Taiwan Dollar, OP = operation.

severity (cancer staging), hospital characteristics (hospital level, hospital ownership) and annual service volume (hospital, physician) as shown in Table 1. For the health condition variable, the extent of comorbidity was presented as (CCI adapted by Deyo et al.[25]

2.4. Analytical methods

We performed the statistical analyses with SAS 9.3 software (SAS Institute Inc., Cary, NC). Because participation/ non-participation in MDT care was not randomized in this observational study, we employed the propensity score matching (PSM) method to reduce selection bias arising from participation/nonparticipation in MDT care.[26] The predicted probability of participating in MDT care was calculated by a logistic regression model including confounders (10 variables). The likelihood of participating in MDT care was the propensity score, and the probability (0-1) was used for matching the closest groups with precision calculation. As a result, the study group and control group were generated for participation and nonparticipation in MDT care, respectively. Chi-square test was performed between the study and control groups to ensure similar distribution with regard to each variable.

First, to evaluate the distribution difference, bivariate analysis of χ^2 test was performed to examine the number of patients who had visited the emergency department within a year of cancer diagnosis for each relevant variable. A t test or analysis of variance (ANOVA) was then performed to analyze the number of visits to the emergency department within a year of cancer diagnosis. Means were calculated, and the differences and correlation were evaluated accordingly.

Next, 2 regression models involving controlled variables (14 variables) were used. A logistic regression model was employed to examine the probability of emergency care used by patients participating or not participating in MDT care within a year of cancer diagnosis. Finally, the Poisson regression model was used to analyze whether participating in MDT care influences the number of visits to the emergency department within a year of cancer diagnosis.

3. Results

The ratio of participation/nonparticipation in MDT care was approximately 1:3 among 24,242 patients; thus, the same ratio was used in PSM. After the matching, a total of 12,156 subjects were included in this study: 3039 colorectal cancer patients participating in MDT care formed the study group, whereas 9117 non-MDT care participants formed the control group (Fig. 1). Chi-square test was then performed to examine the distribution of number of patients in the 2 groups and to determine the distribution was similar with regard to each variable ($P > .05$). The variables included sex, age, monthly salary, CCI, catastrophic illnesses/injuries, colorectal cancer staging, level of the hospital, hospital ownership, annual service volume, and physician service volume, as shown in Table 2.

Table 3 shows the results of χ^2 test performed without the control of other variables to examine the utilization of emergency care within a year of cancer diagnosis and the results of t test or ANOVA performed for each variable to examine the mean number of visits to the emergency department within a year of cancer diagnosis. The percentage difference between participation/nonparticipation in MDT care was 0.03%, and mean and standard deviation values for 2 consecutive variables were the same, showing no significant difference ($P > .05$). However, the utilization of emergency care within a year of cancer diagnosis exhibited significant differences ($P < .05$) in demographic profile, health condition, and treatment method. The most frequent emergency care utilization was observed in the following cases: the youngest group (≤44 years) (28.28%, mean: 0.56 ± 1.44), second-lowest income group (NT$ 1–17,280) in terms of socioeconomic status (26.60%, mean: 0.46 ± 1.09), most severe comorbidity (CCI ≥ 10) (32.33%, mean: 0.48 ± 1.11), colorectal cancer stage IV (37.22%, mean: 0.74 ± 1.51), receiving the most therapies (3) (30.80%, mean: 0.62 ± 1.42), public hospital in

Table 2

Results of study and control groups after PSM.

	Non-MDT			MDT		
	Total	N	%	N	%	P
Sex	12,156	9117	75.00	3039	25.00	.940
Female	4815	3609	74.95	1206	25.05	
Male	7341	5508	75.03	1833	24.97	
Age, yrs						.723
≤44	1128	843	74.73	285	25.27	
45–54	2281	1698	74.44	583	25.56	
55–64	2762	2072	75.02	690	24.98	
65–74	2756	2054	74.53	702	25.47	
≥75	3229	2450	75.87	779	24.13	
Monthly salary (NT$)						.176
Low-income	96	65	67.71	31	32.29	
1–17,280	3354	2549	76.00	805	24.00	
17,281–22,800	5744	4290	74.69	1454	25.31	
≥22,801	2962	2213	74.71	749	25.29	
CCI						.398
0–3	6350	4778	75.24	1572	24.76	
4–6	3375	2548	75.50	827	24.50	
7–9	1163	855	73.52	308	26.48	
≥10	1268	936	73.82	332	26.18	
Catastrophic illness/injury						.309
No	11,879	8917	75.07	2962	24.93	
Yes	277	200	72.20	77	27.80	
Cancer staging						.709
I	1890	1427	75.50	463	24.50	
II	3008	2266	75.33	742	24.67	
III	4534	3403	75.06	1131	24.94	
IV	2724	2021	74.19	703	25.81	
Hospital level						.129
Medical centers	7676	5803	75.60	1873	24.40	
Regional hospital	4414	3264	73.95	1150	26.05	
District hospital	66	50	75.76	16	24.24	
Hospital ownership						.429
Public	3281	2478	75.53	803	24.47	
Private	8875	6,639	74.81	2236	25.19	
Service volume of hospital						.151
Low	158	117	74.05	41	25.95	
Middle	2153	1580	73.39	573	26.61	
High	9845	7420	75.37	2425	24.63	
Service volume of physician						.073
Low	447	334	74.72	113	25.28	
Middle	2744	2013	73.36	731	26.64	
High	8965	6770	75.52	2195	24.48	

CCI = Charlson Comorbidity Index, MDT = multidisciplinary team care, NT$ = new Taiwan Dollar.

terms of hospital ownership (28.16%, mean: 0.28 ± 0.45), lowest service volume of physician (30.20%, mean: 0.58 ± 1.20), most outpatient visits (≥26) (28.13%, mean: 0.52 ± 1.26), and most inpatient visits (≥3) (52.13%, mean: 1.21 ± 1.86).

As shown in Table 4, a logistic regression model involving controlled variables was employed to examine the probability of emergency care used by patients within a year of cancer diagnosis, and the Poisson regression model was used to analyze whether participation in MDT care influenced the number of visits to the emergency department within a year of cancer diagnosis. The logistic regression model involving controlled variables demonstrated that OR for participation MDT care groups within a year of cancer diagnosis was less than that for nonparticipation MDT care groups (odds ratio, OR = 0.87, 95% confidence interval, CI = 0.78–0.96) and exhibited significant differences ($P < .05$); this was different from the results of analysis without controlled variables (shown in Table 3). For controlled variables, the groups with a higher probability of emergency care used by patients within a year of cancer diagnosis were as follows: the youngest group (≤44-years old), colorectal cancer staging IV (OR = 2.71, 95% CI = 2.27–3.25), private hospital (OR = 0.85, 95% CI = 0.77–0.94), most outpatient visits (≥26) (OR = 1.78, 95% CI = 1.51–2.10), and most inpatient visits (≥3) (OR = 4.97, 95% CI = 3.52–7.02); all of these exhibited significant differences ($P < .05$).

Finally, as shown in Table 4, the Poisson regression model involving controlled variables demonstrated that the number of visits to the emergency department within a year of cancer diagnosis was significantly lower in patients participating in MDT care than in those not participating in MDT care ($\beta = -0.19 \pm 0.03$, $P < .05$). This result is different from that of analysis without controlled variables (shown in Table 3). For controlled variables, the groups with a higher utilization of emergency care by patients within a year of cancer diagnosis were as follows:

Table 3

The result of emergency care utilization by bivariate analysis.

	No use		Use						
	N	%	N	%	*P*	N	Mean	STD	*P*
MDT					0.990				.971
No	6966	76.41	2151	23.59		9117	0.24	0.42	
Yes	2323	76.44	716	23.56		3039	0.24	0.42	
Sex					0.404				.391
Female	3699	76.82	1116	23.18		4815	0.23	0.42	
Male	5590	76.15	1751	23.85		7341	0.24	0.43	
Age, y					<.0001				<.001
≤44	809	71.72	319	28.28		1128	0.56	1.44	
45–54	1733	75.98	548	24.02		2281	0.44	1.15	
55–64	2168	78.49	594	21.51		2762	0.36	0.97	
65–74	2174	78.88	582	21.12		2756	0.35	0.94	
≥75	2405	74.48	824	25.52		3229	0.40	0.94	
Monthly salary, NT$					<.0001				.002
Low-income	73	76.04	23	23.96		96	0.36	0.76	
1–17,280	2462	73.40	892	26.60		3354	0.46	1.09	
17,281–22,800	4457	77.59	1287	22.41		5744	0.37	0.98	
≥22,801	2297	77.55	665	22.45		2962	0.39	1.12	
Urbanization level of residence area					0.392				.289
Level 1	2240	75.80	715	24.20		2955	0.41	1.04	
Level 2 & 3	3907	76.10	1227	23.90		5134	0.42	1.11	
Level 4 & 5	2085	77.60	602	22.40		2687	0.37	1.00	
Level 6 & 7	1057	76.59	323	23.41		1380	0.38	0.90	
CCI					<.0001				<.001
0–3	5043	79.42	1307	20.58		2084	0.30	0.83	
4–6	2593	76.83	782	23.17		3628	0.32	0.95	
7–9	795	68.36	368	31.64		2500	0.49	1.21	
≥10	858	67.67	410	32.33		3944	0.48	1.11	
Catastrophic illness/injury					0.377				.453
No	9084	76.47	2795	23.53		11,787	0.24	0.42	
Yes	205	74.01	72	25.99		369	0.22	0.41	
Cancer staging					<.0001				<.001
I	1629	86.19	261	13.81		1890	0.20	0.73	
II	2432	80.85	576	19.15		3008	0.27	0.71	
III	3518	77.59	1016	22.41		4534	0.37	0.95	
IV	1710	62.78	1014	37.22		2724	0.74	1.51	
Therapy					<.0001				<.001
Surgery (OP) only	4564	80.58	1100	19.42		5664	0.30	0.85	
Radiation therapy (RT) only	96	77.42	28	22.58		124	0.32	0.70	
Chemotherapy (CH) only	427	80.57	103	19.43		530	0.29	0.70	
OP + RT	497	72.55	188	27.45		685	0.44	0.95	
P + CH	2616	72.65	985	27.35		3601	0.50	1.20	
RT + CH	96	82.05	21	17.95		117	0.31	0.78	
OP + RT + CH	993	69.20	442	30.80		1435	0.62	1.42	
Hospital Level					<.0001				.004
Medical centers	5771	75.18	1905	24.82		7676	0.42	1.05	
Regional hospital	3473	78.68	941	21.32		4414	0.37	1.03	
District hospital	45	68.18	21	31.82		66	0.67	1.47	
Hospital ownership					<.0001				<.001
Public	2357	71.84	924	28.16		3281	0.28	0.45	
Private	6932	78.11	1943	21.89		8875	0.22	0.41	
Service volume of hospital					0.226				.169
Low	117	74.05	41	25.95		158	0.53	1.14	
Middle	1674	77.75	479	22.25		2153	0.38	1.13	
High	7498	76.16	2347	23.84		9845	0.41	1.03	
Service volume of physician					<.0001				<.001
Low	312	69.80	135	30.20		447	0.58	1.20	
Middle	2057	74.96	687	25.04		2744	0.45	1.25	
High	6920	77.19	2045	22.81		8965	0.38	0.96	
Outpatient visiting					<.0001				<.001
0–5	1412	79.55	363	20.45		1775	0.30	0.77	
6-10	1724	81.86	382	18.14		2106	0.29	0.79	
11-15	1609	78.30	446	21.70		2055	0.34	0.85	
16-20	1247	76.13	391	23.87		1638	0.41	1.07	
21-25	898	72.19	346	27.81		1244	0.51	1.32	
≥26	2399	71.87	939	28.13		3338	0.52	1.26	
Inpatient visiting					<.0001				<.001
0	724	81.99	159	18.01		883	0.26	0.68	
1	6683	82.27	1440	17.73		8123	0.27	0.79	
2	1388	65.53	730	34.47		2118	0.59	1.25	
≥3	494	47.87	538	52.13		1032	1.21	1.86	

CCI = Charlson Comorbidity Index, MDT = multidisciplinary team care, NT$ = new Taiwan Dollar, OP = operation, STD = standard deviation.

Table 4

Effect and factors of MDT on utilization of emergency care by patients within a year of cancer diagnosis.

	Logistic Regression					Poisson Rregression			
	OR	**95%**	**CI**	***P***	β	**STD**	**95%**	**CI**	***P***
MDT									
No	1.00								
Yes	0.87	0.78	0.96	0.008	−0.19	0.03	−0.26	−0.12	<.0001
Sex									
Female	1.00								
Male	1.01	0.92	1.10	0.917	0.13	0.03	0.07	0.19	<.0001
Age, y									
≤44	1.00								
45–54	0.89	0.75	1.06	0.190	−0.12	0.05	−0.22	−0.02	.016
55–64	0.80	0.68	0.95	0.011	−0.29	0.05	−0.39	−0.19	<.0001
65–74	0.82	0.69	0.98	0.031	−0.27	0.05	−0.38	−0.16	<.0001
≥75	1.05	0.88	1.26	0.565	−0.12	0.05	−0.22	−0.01	.028
Monthly salary, NT$									
low-income	1.00								
1–17,280	1.30	0.78	2.16	0.308	0.41	0.17	0.07	0.74	.018
17,281–22,800	1.13	0.68	1.87	0.641	0.28	0.17	−0.06	0.61	.104
≥22,801	1.10	0.66	1.83	0.720	0.25	0.17	−0.09	0.58	.154
Urbanization level of residence area									
Level 1	1.00								
Level 2 & 3	1.10	0.98	1.23	0.102	0.12	0.04	0.05	0.19	.001
Level 4 & 5	1.13	0.98	1.30	0.104	0.13	0.05	0.04	0.22	.006
Level 6 & 7	1.17	0.98	1.39	0.081	0.11	0.06	0.00	0.23	.045
CCI									
0–3	1.00								
4–6	1.16	1.00	1.34	0.046	0.17	0.05	0.07	0.26	.001
7–9	0.96	0.83	1.13	0.647	0.01	0.05	−0.09	0.11	.836
above 10	0.91	0.79	1.06	0.244	−0.10	0.05	−0.20	0.00	.058
Catastrophic illness/injury									
No	1.00								
Yes	0.88	0.67	1.14	0.329	−0.08	0.09	−0.25	0.10	.391
Cancer staging									
I	1.00								
II	1.29	1.10	1.52	0.002	0.16	0.06	0.04	0.28	.012
III	1.46	1.25	1.72	<.0001	0.34	0.06	0.23	0.46	<.0001
IV	2.71	2.27	3.25	<.0001	0.90	0.06	0.78	1.03	<.0001
Therapy									
OP only	1.00								
RT only	1.30	0.77	2.17	0.327	0.12	0.18	−0.24	0.47	.529
CH only	1.03	0.71	1.49	0.869	−0.05	0.12	−0.29	0.19	.689
OP + RT	1.11	0.91	1.35	0.301	0.02	0.07	−0.11	0.15	.774
OP + CH	0.95	0.84	1.07	0.379	−0.03	0.04	−0.10	0.05	.517
RT + CH	0.84	0.47	1.48	0.535	−0.10	0.19	−0.47	0.27	.592
OP + RT + CH	0.94	0.80	1.11	0.477	0.02	0.05	−0.07	0.12	.632
Hospital level									
Medical centers	1.00								
Regional hospital	0.77	0.68	0.87	<.0001	−0.18	0.04	−0.26	−0.10	<.0001
District hospital	1.19	0.66	2.15	0.574	0.24	0.17	−0.09	0.57	.154
Hospital ownership									
Public	1.00								
Private	0.85	0.77	0.94	0.002	−0.06	0.03	−0.12	0.01	.092
Service volume of hospital									
Low	1.00								
Middle	1.01	0.67	1.52	0.977	−0.10	0.12	−0.34	0.14	.425
High	0.97	0.64	1.48	0.903	−0.08	0.12	−0.32	0.16	.521
Service volume of physician									
Low	1.00								
Middle	0.92	0.73	1.16	0.489	−0.10	0.07	−0.24	0.03	.132
High	0.91	0.73	1.14	0.424	−0.16	0.07	−0.29	−0.03	.015
Outpatient visit									
0–5	1.00								
6–10	1.10	0.93	1.31	0.260	0.20	0.06	0.08	0.31	.001
11–15	1.35	1.14	1.60	0.001	0.31	0.06	0.20	0.43	<.0001
16–20	1.48	1.24	1.76	<.0001	0.46	0.06	0.34	0.57	<.0001
21–25	1.78	1.47	2.15	<.0001	0.64	0.06	0.52	0.77	<.0001
≧26	1.78	1.51	2.10	<.0001	0.61	0.06	0.51	0.72	<.0001
Inpatient visit									
0	1.00								
1	1.21	0.88	1.68	0.242	0.18	0.11	−0.04	0.40	.106
2	2.58	1.85	3.60	<.0001	0.80	0.11	0.58	1.03	<.0001
≧3	4.97	3.52	7.02	<.0001	1.43	0.11	1.20	1.65	<.0001

CCI = Charlson Comorbidity Index, CH = chemotherapy, MDT = multidisciplinary team care, NT$ = New Taiwan Dollar, OP = surgery, OR = odds ratio, RT = Radiation therapy, STD = standard deviation.

males (β = 0.13, 95% CI = 0.07–0.19), the youngest group (≤44 years old), medium urbanization level of residence area (Level 4 & 5) (β = 0.13, 95% CI = 0.04–0.22), colorectal cancer stage IV (β = 0.90, 95% CI = 0.78–1.03), and most inpatient visits (≥3) (β = 1.43, 95% CI = 1.20–1.65); all of them exhibited significant differences ($P < .05$).

4. Discussion

This study discovered that MDT can effectively reduce the number of emergency treatment events for colorectal cancer patients. It explained that patients participate in MDT can lead to a better clinical condition for colorectal cancer patients. The findings concerning these 2 emergency care utilization indicators are not only consistent with those reported in a lung cancer study,[12] which used the same observation indicators, but also MDT is helpful in increasing the survival rate of colorectal cancer patients[11]; similar findings have also been reported in numerous studies on other cancers, such as non-small cell lung cancer[13] and oral cancer,[14,15] in Taiwan. In Taiwan, further inference that cancer treatment and care quality have been enhanced with the successful implementation of MDT, indicating that MDT is an effective health policy. However, in contrast the unanimous results from Taiwan, 2 systematic literature reviews indicated that conclusions regarding MDT were not unanimous in the rest of the world, where several studies discovered that the treatment effect of MDT was rather limited.[5,18] In addition to the differences in the aspect of implementation, research quality may contribute to varying conclusions. Some studies have proposed possible causes, including the lack of using whole population cohort study, not using comparison groups of MDT, not controlling adequately for potentially confounding and others, as reasons for these discrepancies.[5] This generational research-based study used nationwide population as study subjects (45,418 patients), divided the patients into study and control groups, and used 2 steps to control adequately for potentially confounding.[27] As shown in Table 2, the PSM technique was used to decrease the selection bias between joining and not joining MDT. The logistic/Poisson regression model and 14 control variables were then employed to eliminate the interferences on dependent variables (using/not using emergency care). As Table 3 shows, without control variables, whether patients joined the MDT did not have an obvious influence on using emergency care. However, as shown in Table 4, patients joined the MDT had obvious reductions in the probability of emergency care (OR) and the number of visits to the emergency department (β) after controlling for variables. As a whole, these research steps have fully indicated that, in terms of the demands and suggestions for a high-quality research method, this study is similar to the studies mentioned above.[4,5,27–29] In addition, this study reached the same conclusions similar to outcomes of other MDT studies in Taiwan, and also got a positive conclusion.[11–15]

This study, in which conclusions were arrived at based on rigorous research methods, indicates that it is feasible to employ "the status of using emergency treatment" as a reference indicator of quality of MDT-based treatment and care of colorectal cancer patients. We hope that the proposed reference indicator "the status of using emergency treatment" intended to serve as the basis for medical management units and government to enact health policies, can help to enhance the MDT-based treatment and care of colorectal cancer patients, and can be easily and effectively measured.

Although some studies have shown that there is no discrimination in terms of age in the healthcare system, the incidence, treatment and care of colorectal cancer have significant differences in different age groups. For example, young age is associated with advanced stage and higher recurrence of colorectal cancer in comparison with older age, while the young patients are more active in treatment than old patients.[30] One study compared probability of 27 cancer specific variations in emergency care utilization. Although no notable age differences were detected in many cancers, the probability of emergency care utilization had a U-shaped relationship with age in colorectal cancer case,[31] such that the probability of emergency care utilization initially decreased (represented by a negative slope until the age of 55–64 years) and then increased (positive slope) with age. We found similar results; the least probability of emergency care utilization appeared in the age group of 55 to 64 years, and the overall probability of emergency care utilization exhibited a U-shaped relationship with age. In addition, the results of the 2 studies mentioned above and those of the current study indicated that the probability of emergency care utilization had an extremely similar distribution between age groups. However, the sample of this study included residents of Taiwan, which is apparently different from that of the above 2 studies (United Kingdom and United States). The race, geographic location, diet, and medical conditions differ as well, but the conclusion is similar.

On the other hand, the finding of 2 studies with regard to the probability of emergency care utilization by sex was not consistent. One study indicated that male colorectal cancer patients had a higher risk of respiratory or surgery complications; the interventional measures resulted in a higher probability of emergency care utilization in males than in females.[30] The result of the current study also showed more emergency care utilization in males than in females, and there was a significant difference. On the other hand, the opposite was demonstrated in another study, in which 27 types of cancers were analyzed, and in 12 of these, an apparently higher probability of emergency care utilization was observed in males than in females. However, female had a higher probability of emergency care utilization than males in 7 of the cancers. Among these 7 cancers, the probability of emergency care utilization in colorectal cancer was apparently higher in females than in males, and the difference was significant.[31] It can be inferred from this study that the differences may be caused by the characteristics of each study sample, and further investigation targeted at larger samples is required. After examining the probability and frequency of emergency care utilization presented by other variables, we found that the deterioration of health conditions, such as advanced cancer staging and increase in outpatient visits and inpatient visits, increases the probability and frequency of emergency care utilization and there were significant differences among groups, which is consistent with the results of many studies on survival of patients with colorectal cancer.[11,32,33] Some studies suggested that patients with advanced colorectal cancer received the best quality of overall treatment with MDT,[34,35] which means that with the advance of colorectal cancer, the challenges to diagnosis, treatment and care would be greater. We hope to see more investigators dedicate their research in this area in the future. However, this study was limited to the secondary database, and patient emergency care by the urgency level was not addressed; therefore, the necessity was not investigated either. This may be considered in a future study.

5. Conclusions

The aim of this study was to investigate the effect of MDT on colorectal cancer care. Using nationwide population as the study subjects, and controlling adequately for potentially confounding, this study discovered that the 13% probability of emergency care for patients was decreased in patients participating in MDT. On an average, the number of emergency department visit decreased by 0.19 per patient. This suggested that MDT was favorable in achieving better clinical outcomes in patients. Moreover, this study suggests that the 2 quantitative indicators of the status of using emergency treatment be used as an important reference indicator for the quality of MDT-based treatment and care for colorectal cancer patients, which could serve as a basis for subsequent medical management and enactment of policies. This study, in which a large amount of data was collected and rigorous statistical methods were used, confirmed that MDT could enhance the quality of cancer treatment and care, which should be strongly recommended in other countries as an advantageous solution for improving the quality of treatment and care of colorectal cancer patients.

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