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Occupational Therapy After Myocardial or Cerebrovascular Infarction: Which Factors Influence Referrals?

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Occupational Therapy After Myocardial or Cerebrovascular Infarction: Which Factors Influence Referrals?

Abstract

Background: Cardiovascular diseases remain the number one cause of death worldwide, and many survivors suffer lasting disabilities. Occupational therapy can help such patients regain as much function as possible. However, little is known about the factors influencing referrals to occupational therapy after stroke or myocardial infarction (MI).

Method: Data from the IMS Disease Analyzer® database were observed for a three-year period. The study population included 7,440 patients who were examined by a cardiologist due to stroke or MI. In addition to baseline characteristics, the presence of certain cardiovascular risk factors or comorbidities was recorded. Cox regression analyses were performed and the Charlson Comorbidity Index (CCI) was utilized.

Results: Occupational therapy was received by 1,779 patients; 88.5% had suffered an MI and 11.5% a stroke. In the group without referral (n = 5,661), 60.7% had experienced an MI and 39.3% a stroke. No significant gender-related differences were observed. Younger age, an MI diagnosis, and the presence of hypertension positively influenced referral rate and time, while risk factors, such as adiposity, delayed therapy. The CCI was higher in the group with occupational therapy.

Conclusion: The chance of being offered occupational therapy increased with younger age, history of MI, and the presence of hypertension. Future studies should also consider severity of ischemic lesion to account for the degree of remaining impairment.

Keywords

occupational therapy, ischemia, brain, heart, prescription, and referral patterns

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Despite improvements in evidence-based treatments in recent years, cardiovascular diseases are still the leading cause of mortality worldwide, having wide-reaching socioeconomic consequences. They accounted for 34.5 million deaths in 2010 (Lozano et al., 2012). Reduced oxygen supply to the brain can lead to a transient ischemic attack (TIA), to prolonged reversible ischemic neurologic deficit (PRIND), or, in the worst case, to a stroke. The latter is classified based on the cerebral artery affected or the size of the infarct, with four main subtypes used in literature that accurately predict the site and size of the lesion in approximately three-quarters of cases (Aerden et al., 2004): (a) total anterior circulation infarct (TACI), (b) partial anterior circulation infarct (PACI), (c) lacunar infarct (LACI), and (d) posterior circulation infarct (POCI) (Bamford, Sandercock, Dennis, Warlow, & Burn, 1991).

Background

It is estimated that of the 15 million individuals who sustain a stroke worldwide annually, five million die, five million survive without permanent disability, and five million survive with permanent disability (Thrift et al., 2014). Those who survive a first stroke remain at high risk for experiencing another stroke within months of the initial stroke (Giles et al., 2011). In the majority of cases, patients with a TACI have the severest impairment and disability profile, as well as the largest number of complications in the course of the disease (Pittock et al., 2003). Consequently, their prognosis is considerably worse in terms of hospitalization duration, recovery, independence, and mortality when compared to other ischemic subtypes (Lemon, Ashburn, & Hyndman, 2009; Pittock et al., 2003).

Another common cardiovascular disease is myocardial infarction (MI), which also is linked with a high rate of remaining disabilities and medical complications in survivors. It accounts for approximately seven million deaths worldwide annually and is responsible for 13% of all male and 12% of all female deaths (Nguyen et al., 2011). Together with stroke, it is estimated that mortality due to MI will continue to increase until 2030, when it will reach approximately 23.3 million deaths worldwide (Schmidt, Jacobsen, Johnsen, Bøtker, & Sørensen, 2014).

Published studies have consistently shown that, although many patients with a history of MI or stroke have at least one comorbidity (Schmidt et al., 2014), most of them do not sustain adequate risk management measures, although knowledge of existing cardiovascular risk factors is important to prevent further ischemic events (Ellis & Breland, 2014). For example, Marshall, Wang, McKevitt, Rudd, and Wolfe (2013) examined trends in risk factor prevalence and management in a large population of 4,416 patients who had experienced a first stroke. They found that almost three-quarters had been previously diagnosed with one or more cardiovascular risk factors. Even higher percentages were found in a study of 1,297 patients suffering from atrial fibrillation, of whom almost all (98%) had at least one additional comorbidity and 90% had cardiovascular comorbidities (LaMori et al., 2013).

In addition to the number of risk factors present in a patient, however, a combination of these factors also seems to play an important role

in the development of ischemic events, as described in a recent study (van Rooy & Pretorius, 2013). As a consequence of such an interaction, the prognosis may worsen beyond that expected on the basis of the individual effects of each comorbid condition alone (Schmidt et al., 2014; van Rooy & Pretorius, 2013).

As previously mentioned, both stroke and MI survivors often have significant impairments to their cognitive, sensory, and/or motor functions. Therefore, post-infarction programs include therapies that are aimed at regaining as much functionality as possible. Occupational therapy has established itself as an important part of an interdisciplinary therapeutic approach (Steib & Schupp, 2012; Walker et al., 2004). According to the American Occupational Therapy Association (1994), ample evidence indicates that it can be used "to achieve functional outcomes which promote health, prevent injury or disability, and which develop, improve, sustain or restore the highest possible level of independence" (p. 1073). Several studies have confirmed the benefits of occupational therapy as part of the interdisciplinary management of stroke and MI survivors (Lemon et al., 2009; Ngo, Latham, Jette, Soukup, & Iezzoni, 2009; Pasquali, Alexander, & Peterson, 2001; Pasquali, Alexander, Coombs, Lytle, & Peterson, 2003; Steib & Schupp, 2012; Wolf, Baum, & Conner, 2009).

Occupational therapy predominantly focuses on the improvement of instrumental activities of daily living (IADLs), personal activities of daily living (PADLs), physical function, perception, or cognition/mood; however, it also may include career education (Lemon et al., 2009). Despite these proven positive effects of occupational therapy, little is known regarding referral practice patterns in patients with impairments after stroke or MI.

Aims of Study

The aims of this study were to assess:

- How many patients received occupational therapy after brain or cardiac infarction in a specific patient population in Germany
- How long it took until first therapy after the ischemic event
- Which factors influenced whether a patient did or did not receive occupational therapy

Method

This study was a retrospective database analysis in Germany utilizing the Disease Analyzer® Database (IMS Health, Frankfurt am Main, Germany). This database is an established tool that facilitates data collection directly from computer systems used in the practices of participating doctors (Kostev, 2010). It provides information on diagnoses (ICD-10 codes) and drug prescriptions, as well as basic medical and demographic data. The quality of the data, such as the completeness of documentation or linkages between diagnoses and prescriptions, is monitored by IMS Health. The data are generated directly from the computers in physicians' practices via standardized interfaces that supply daily routine information about patients' diseases and therapies.

Patients and practices can be analyzed in a cross-sectional and a longitudinal manner. Longitudinal data dating back to 1992 are available. In total, the database contains millions

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of records from more than 3,000 physicians in Germany. In addition to data from general practitioners and specialists in internal medicine, data for various specialist groups also are recorded. The Disease Analyzer database provides a complete listing of all relevant patient details for each practice. The data bank includes only anonymized data, in compliance with the regulations of the country's applicable data protection laws (Kostev, 2010).

The sampling method for the Disease Analyzer database is based on summary statistics from all doctors in Germany, which is published yearly by the German Medical Association (Bundesärztekammer) [http://www.baek.de]. The statistical unit of IMS Health uses these statistics to determine the panel design according to the following strata: (a) specialist group, (b) German federal state, (c) community size category, and (d) age of physician. This panel design formed the basis for the acquisition of data in this study from the practices processed in the Disease Analyzer. The sampling methods for the selection of physicians' practices were appropriate; a smaller dataset was extracted from the entire data set to obtain a representative database relevant to occupational therapy and the aims of this study (Becher, Kostev, & Schröder-Bernhardi, 2009).

Participants

The study population included a total of 7,440 subjects with statutory health insurance from 10 cardiologists' practices. Of these, 1,779 patients (24%) received prescribed occupational therapy within three years after diagnosis of either myocardial infarction (88.5%) or stroke (11.5%). The remaining 5,661 patients (76%) did not receive such therapy (MI: 60.7%; Stroke: 39.3%) (see Table 1). The mean age was significantly different between the two groups ($p < .0001$), with 65.9 (±10.6) years of age the mean in the group who received referrals and 67.4 (±12.3) the mean in those who did not.

Table 1

Baseline Characteristics of Patients with MI or Stroke Diagnosis From 10 Cardiologists' Practices in Germany

Variables	**Patients with occupational therapy referral Means (*SD*) or proportions (%)**	**Patients without occupational therapy referral Means (*SD*) or proportions (%)**	***P* value**
N	1,779	5,661	
Mean age (years)	65.9 (10.6)	67.4 (12.3)	< .0001
Age </= 60 years	22.3	24.5	.1136
Age 61-70 years	27.7	23.5	.0006
Age 71-80 years	35.7	34.0	.1965
Age > 80 years	14.3	18.3	.0002
Male gender (%)	74.4	66.9	< .0001
Index diagnosis			
Myocardial infarction	88.5	60.7	< .0001
Stroke	11.6	39.3	< .0001
Diagnosed comorbidity[a] (%)			

Charlson Comorbidity Index	1.9 (0.4)	1.7 (0.7)	< .0001
Diabetes	16.5	24.9	< .0001
Adiposity	9.1	17.9	< .0001
Nicotine dependence	4.9	13.8	< .0001
Heart insufficiency	12.9	23.4	< .0001
Peripheral artery disease (PAD)	1.6	9.9	< .0001
Hypertension	76.8	51.6	< .0001

[a] Primary care diagnoses prior to index date.

Data Analysis

The observation period was three years in length, from January 1, 2010, until December 31, 2012. The day of first diagnosis of MI or stroke was set as the "index date." The time until first referral for occupational therapy over three years was noted as the main outcome measure of this study. In addition, the presence of cardiovascular risk factors or comorbidities was analyzed, including nicotine dependence, adiposity, diabetes, heart insufficiency, hypertension, and peripheral arterial disease (PAD). ICD 10 codes were used to establish diagnoses (see Table 2).

Table 2
ICD 10 Codes for Diagnoses Analyzed in Study

Diagnosis	**ICD 10 Code Used**
Myocardial infarction	I21, I22, I23, I25
Stroke	I60, I61, I62, I63, I64, I69
Nicotine dependence	F17
Adiposity	E65, E66, E67, E68
Diabetes	E10, E11, E14
Heart insufficiency	I50
Hypertension	I10
Peripheral arterial disease	E104, E114, E144, I739

Chi-squared and Wilcoxon signed-rank tests were performed to look for statistical differences between patients with and without occupational therapy referrals, with a *p*-value of < .05 representing statistical significance. Results were given as mean ± standard deviations or proportions (%).

The Charlson Comorbidity Index (CCI) was used to separately evaluate patients with and without referrals for occupational therapy. This index helps therapists decide how aggressively to treat a condition by estimating the 10-year mortality rate for a patient with comorbidities. This is done by calculating the weighted sum of the following conditions: human immunodeficiency virus (HIV) or acquired immune deficiency syndrome (AIDS), metastatic tumor, lymphoma, leukemia, any tumor, moderate or severe renal disease, ulcer disease, connective tissue disease, chronic pulmonary disease, dementia, MI, peripheral arterial disease (PAD), diabetes, stroke, heart failure, hemiplegia, or

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diabetes (LaMori et al., 2013).

Cox regression analyses were performed to establish the association of occupational therapy referral within three years with predefined impact variables, such as age, hypertension, or adiposity (defined as Body Mass Index ≥ 30 kg/m^2). A Cox regression is a statistical technique for exploring the relationship between the time to event and several explanatory variables (Walters, 2009).

Kaplan-Meier curves were plotted to determine the time elapsed from diagnosis of either stroke or MI until occupational therapy referral. These were also used to assess possible differences in time to referral in patients with or without nicotine dependence or adiposity (expressed in months since the start of therapy). All analyses were carried out using SAS software version 9.3 (SAS Institute, Inc., Cary, NC), a computer programming language used for statistical analyses (Winn, 2001).

Results

Table 1 provides an overview of the baseline characteristics of both groups and also gives information about diagnosed comorbidities (primary care diagnoses prior to the index date). As can be seen in Table 1, there were considerable differences between patients in the two groups (i.e., those with and without referrals) regarding all comorbid disorders examined. This included diabetes, adiposity, nicotine dependence, heart insufficiency, peripheral artery disease (PAD), and hypertension (for all, $p < .0001$). Apart from hypertension, the proportion of patients suffering from these comorbidities was significantly higher in subjects without an occupational therapy referral. The Charlson Comorbidity Index, however, was higher in individuals with referral: 1.9 (± 0.4) versus 1.7 (±0.7).

Table 3 includes results from the Cox regression analyses. Study results showed that younger age, sustaining an MI, or the presence of hypertension positively influenced the chance of receiving occupational therapy.

Table 3
Association of Occupational Therapy Prescription Within 3 Years With Predefined Impact Variables (Cox Regression Analyses)

Outcome Variables	Hazard Ratio (95% CI)	*P*-value
Age </= 60 years	1.34 (1.13-1.59)	.0008
Age 61-70 years	1.37 (1.16-1.61)	.0002
Age 71-80 years	1.16 (0.99-1.36)	.0625
Myocardial infarction[a]	2.39 (2.06-2.77)	< .0001
Hypertension	1.77 (1.49-2.10)	< .0001
Nicotine dependence	0.16 (0.13-0.21)	< .0001
Diabetes	0.61 (0.49-0.77)	< .0001
PAD	0.12 (0.07-0.18)	< .0001
Adiposity	0.18 (0.16-0.22)	< .0001

[a] Primary care diagnoses prior to index date.

When comparing data from survivors of stroke and MI, the Kaplan-Meier curve (see Figure 1) reveals that patients with MI received occupational therapy at a considerably earlier point than those with stroke. In addition, significantly less time elapsed until occupational therapy referral for non-smoking subjects (see Figure 2) and patients not suffering from adiposity (see Figure 3).

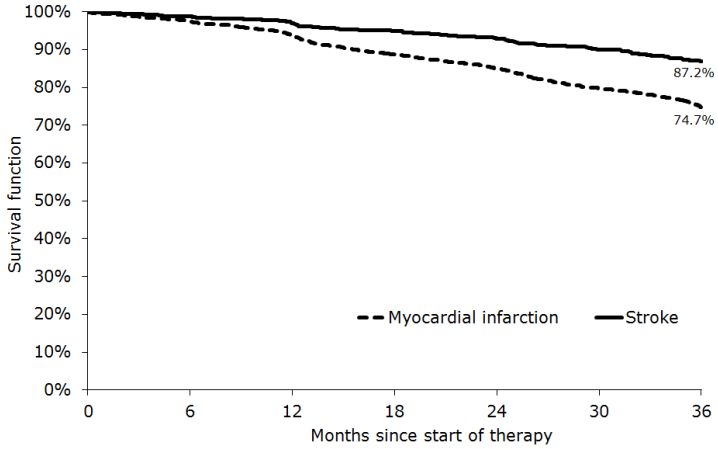

Figure 1. Kaplan-Meier Curves for Time to Occupational Therapy Referral in Patients With MI or Stroke

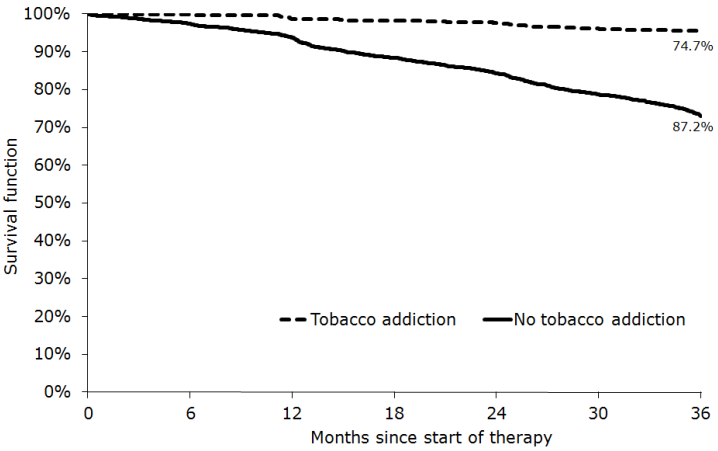

Figure 2. Kaplan-Meier Curves for Time to Occupational Therapy Referral in MI or Stroke Patients With and Without Nicotine Dependence

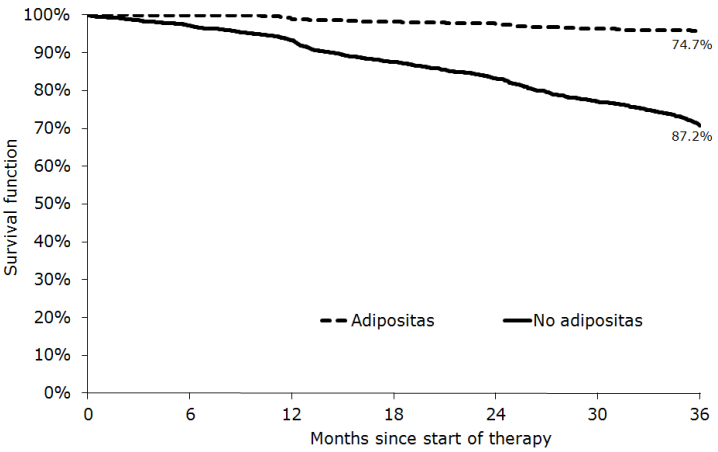

Figure 3. Kaplan-Meier Curves for Time to Occupational Therapy Referral in MI or Stroke Patients With and Without Adiposity

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After examining cardiologists' referral practices in patients sustaining either MI or stroke, and the factors influencing whether a patient did or did not receive occupational therapy, the following main findings emerged:

- Occupational therapy was prescribed significantly earlier and more frequently after MI as compared with stroke.
- The younger the client was, the better his or her chances of receiving occupational therapy.
- No gender-related differences existed (after adjustment) with regard to referral to occupational therapy.
- Patients with several different co-diagnoses were referred more frequently for occupational therapy.
- Except for hypertension, all other comorbidities (e.g., diabetes, adiposity, nicotine dependence) negatively influenced and delayed referral to occupational therapy.

Discussion

The results of this study showed that, of an initial population of 7,440 individuals, only 1,779 (24%) were referred to occupational therapy by a cardiologist within three years after their first diagnosis. Of these, 88.5% had been diagnosed with MI and 11.5% with stroke. There could be several reasons for this. For example, it may be caused by the budgeting for remedies and the fear of compensation claims for statutory health insurance funds. It may be due to the complexity of the Heilmittelverordnung (remedy directive) for those covered by statutory health insurance funds. Or it may be influenced by the lengthy time frame until the noticeable onset of action (Engel, 2012), which could negatively affect the motivation of the prescribers and patients alike and lead to noncompliance. Perhaps, in this case, factors such as a low regard for this form of therapy and seemingly negligible evidence for its effectiveness also play a role. The latter could be a result of the great heterogeneity pertaining to the quality of studies, methodological difficulties, or even the fact that there is no endpoint in the strictest sense for many ergotherapeutical interventions. In addition, a lack of knowledge regarding the possible applications of ergotherapy is a likely component, as has been speculated by Engel (2012) in connection with rheumatology patients.

Several studies have demonstrated the importance of rate and time of return to work after an ischemic event because it influences the patient's quality of life and also has economic consequences for both the patient and society. Nowadays, occupational therapy has expanded rehabilitation beyond mere acute management to address full participation in work, family, and community life (Wolf et al., 2009). Therefore, it is not surprising that, in this study, age significantly influenced the number of patients receiving occupational therapy and the time elapsed until such therapy was prescribed. This finding is supported by the fact that younger age (< 60 years) significantly enhances the effectiveness of occupational therapy after stroke (Petrushevichene, Krishchunas, & Savitskas, 2007). However, similar to the findings of Ngo et al. (2009), this study was unable to establish any gender-related differences; others have observed

that male patients are at an advantage in terms of rehabilitation (Marshall et al., 2013; Petrushevichene et al., 2007).

In the current study, with the exception of hypertension, other risk factors, such as adiposity, nicotine dependence, or diabetes, were detected more frequently in the patients who had not been referred to occupational therapy. This may be an indication of a more severe cardiac or cerebral ischemic event within this group, which did not permit these patients to attend occupational therapy. One would have expected, however, that this would have led to a higher CCI in the non-occupational therapy group, given that the CCI includes significant residual disabilities, such as heart insufficiency or hemiplegia.

When comparing the prevalence of various risk factors in this study with those in the existing literature, a recent study by Silverman et al. (2013) demonstrated that the mean prevalence of diabetes and hypertension were lower, while the rate of smokers was higher. However, Del Bene, Makin, Doubal, Inzitari, and Wardlaw (2013) described a comparable rate of hypertensive patients (73%) in their study. LaMori et al. (2013) also came up with similar results for both hypertension (71%) and diabetes (23%). While the prevalence of diabetes was in the same range as this study (14.7%), Radovanovic et al. (2014) had considerably more adipose (23.1%) and smoking subjects (29.3%) in their study population. Thus, one can state that the prevalence of cardiovascular risk factors varies considerably among different studies.

Limitations

This study has several limitations that need to be addressed. First, the majority of patients receiving occupational therapy sustained MI and not stroke (88.5% versus 11.5%), although it is known that occupational therapy is prescribed more often after strokes than MIs. This heterogeneity may have biased the study results.

Only outpatients were included in this study, so the results might have been influenced by the fact that subjects had suffered a lower degree of stroke/MI; most patients with more serious ischemic events are treated in hospitals and/or need to be admitted subsequently to a nursing home. Moreover, the severity of the ischemic event is known to affect rehabilitation interventions (Lemon et al., 2009).

Neither the location nor the magnitude of ischemia was recorded, although the type of functional impairment may have had an influence on referral patterns. It has also been established that patients with lacunar ischemic stroke have a different risk factor profile than other non-lacunar stroke subtypes (Jackson et al., 2009, 2010). Furthermore, the possibility cannot be excluded that information on the presence of cardiovascular risk factors was incomplete due to inadequate registration of relevant ICD-10 codes.

In addition, information about nicotine dependence can only be assessed by questioning patients. These data are, therefore, subjective, which might explain the low percentage, especially in the group of patients referred to occupational therapy (4.9%). However, results for the group that did not receive occupational therapy (13.8%) were comparable to the situation

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described by Silverman et al. (2013), who measured a mean smoker rate of 15.3% in their study.

This study did not identify and explore whether another ischemia, which may have delayed the beginning of occupational therapy, occurred during the course of disease. Finally, it is common knowledge that many factors, including financial resources, could explain the use of rehabilitation therapies, such as the availability of rehabilitation services or patients' own preferences with regard to these therapies (Ngo et al., 2009).

Implications for Clinical Practice

Regardless of patient age and comorbidity, it is important to refer patients for occupational therapy as soon as possible. Although both nicotine addiction and adiposity are risk factors for an additional MI or stroke, these factors cannot easily be eliminated. Timely referral to occupational therapy is neither impossible nor less helpful for patients with risk factors; the aim of occupational therapy is not to lower the risk of a further ischemic event, but to assist the patient's return to a normal life and to employment.

Conclusion

This study showed that in a large population of patients with stroke or MI, younger age, history of MI, or hypertension positively influenced the referral rate and time of occupational therapy. Those with other risk factors, such as nicotine dependence or adiposity, attended such rehabilitation programs significantly less often. It will be the task of future studies to confirm these results. Future studies also should consider the severity of ischemic lesion to account for the degree of remaining impairment. Ultimately, this additional research may lead to changes in the therapeutic regimen for certain patients.

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