

Clinical Research

Neighbourhood Income and Cardiac Rehabilitation Access as Determinants of Nonattendance and Noncompletion

Mark E. Lemstra, PhD,^{a,b} Wasem Alsabbagh, BSc,^c Ruben J. Rajakumar, MD, FRCPC,^b

Marla R. Rogers, MPA,^a and David Blackburn, PharmD^c

^a College of Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

^b Saskatchewan Heart Center, Saskatoon, Saskatchewan, Canada

^c College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

ABSTRACT

Background: Despite known benefits of exercise-based cardiac rehabilitation (CR), attendance and completion rates remain low. Our objective was to review attendance and completion of CR overall and by level of neighbourhood income in Saskatoon, Canada and then determine the effect of opening a new CR facility in close proximity to low-income neighbourhoods.

Methods: From January 2007 to December 2011, our retrospective cohort included hospital discharge data, CR attendance, and completion rates, stratified according to neighbourhood income, and adjusted for sex and age.

Results: Residents from low-income neighbourhoods were more likely (odds ratio [OR], 1.76; 95% confidence interval [CI], 1.60–1.94) to be hospitalized for ischemic heart disease (IHD), percutaneous transluminal coronary angioplasty (PTCA), or coronary artery bypass graft (CABG) than residents from high-income neighbourhoods. Among those hospitalized for IHD, PTCA, or CABG, 12.7% attended CR. Patients of low-income neighbourhoods were less likely (OR, 1.58; 95% CI, 1.39–1.71) to attend CR than patients of high-income neighbourhoods. Among those who attended, 66.7% quit before program

RÉSUMÉ

Introduction : En dépit des avantages connus de la réadaptation cardiaque (RC) par l'exercice, les taux de participation et d'achèvement semblent faibles. Notre objectif était d'étudier la participation et l'achèvement de la RC dans l'ensemble et par niveau de revenu selon les quartiers, à Saskatoon, au Canada, puis de déterminer l'effet de l'ouverture d'un nouvel établissement de RC à proximité immédiate des quartiers à faible revenu.

Méthodes : De janvier 2007 à décembre 2011, notre cohorte rétrospective incluait les données sur les sorties d'hôpital, les taux de participation et d'achèvement de la RC stratifiés selon le revenu dans le quartier, et ajustés selon le sexe et l'âge.

Résultats : Les résidents des quartiers à faible revenu étaient plus susceptibles (ratio d'incidence approché [RIA], 1,76; intervalle de confiance [IC] à 95 %, 1,60–1,94) d'être hospitalisés pour une cardiopathie ischémique (CI), une angioplastie coronarienne transluminale percutanée (ACTP) ou un pontage aortocoronarien (PAC) que les résidents des quartiers à revenu élevé. Parmi ceux hospitalisés pour une CI, une ACTP ou un PAC, 12,7 % participaient à la RC. Les patients des quartiers à faible revenu étaient moins susceptibles (RIA,

Cardiac rehabilitation (CR) is defined as a comprehensive program including exercise, education, counselling, and risk factor modification for those with cardiovascular disease.¹

A systematic review of randomized controlled trials examining the effectiveness of exercise-based CR found that these programs reduce overall mortality by 13%, cardiovascular mortality by 26%, and hospital admissions by 31%, although they do not have any effect on reducing the risk of

total myocardial infarction.² In comparison, education-based CR programs, without an exercise component, have not demonstrated benefits to these major health outcomes.³

Despite known benefits to patients attending exercise-based CR programs, enrollment and completion rates are low. One review found that only a third of eligible patients attend, and among those who do attend, only a third actually complete the program.⁴ Factors associated with nonattendance and noncompletion included older age, female sex, having fewer years of formal education, not perceiving benefits of the program, and having angina.⁴ A second review found nonattendance was influenced by lack of support from the patient's physician, lower education level, being married, less self-efficacy, and poor access.⁵ A third review found that noncompletion of CR was affected by low mood, older age, and cardiovascular risk factors.⁶

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Corresponding author: Marla R. Rogers, Department of Physical Medicine and Rehabilitation, 7th Floor, Saskatoon City Hospital, 701 Queen St, Saskatoon, Saskatchewan S7K 0M7, Canada. Tel.: +1-306-655-8662; fax: +1-306-655-8813.

E-mail: marla.rogers@usask.ca

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completion. Participants from low-income neighbourhoods were more likely (OR, 1.38; 95% CI, 0.57-3.50) to not complete CR. In total, only 4.2% of patients hospitalized for IHD, PTCA, or CABG started and completed CR. Expanding access to those living in low-income neighbourhoods did not increase attendance (OR, 1.31; 95% CI, 0.79-2.19) or completion rates (OR, 1.25; 95% CI, 0.23-2.41) to a significant level.

Conclusions: High rates of nonattendance and noncompletion of CR were observed. Living in a low-income neighbourhood was associated with lower rates of attendance and completion. Expanding access to CR did not increase attendance or completion among patients of low-income neighbourhoods to a significant level.

Among these 3 systematic literature reviews, physician endorsement, ease of physical access, and distance to CR were determined to be the strongest predictors. Among the socio-economic variables, the only one to have a consistent effect on CR attendance or completion was education.^{4,5}

A meta-analysis reviewed all studies attempting to improve completion rates of CR. Among 7 high-quality studies identified, only 2 slightly improved completion whereas 5 did not. Although the authors concluded that few practice recommendations for increasing completion could be made, they believed that interventions targeting barriers identified by patients (ie, access and distance) might increase the likelihood of success.⁷

The authors were not able to find a study that assessed the effect of income on attendance or completion of CR programs. As such, our first objective was to review the effect of neighbourhood income on attendance and completion of CR in the city of Saskatoon, Canada. Our second objective was to determine the effect of opening a new CR facility in close proximity to low-income neighbourhoods, measured according to attendance and completion rates, in a 2-year period before vs a 2-year period after the new CR facility opened.

Methods

A retrospective cohort of all live patients discharged from any hospital in the Saskatoon Health Region between January 2007 to December 2011 with a primary or most responsible discharge diagnosis of ischemic heart disease (IHD) (ICD 10 CA: I20-I25) was identified by Strategic Health Information Planning Services from the health region.⁸ The number of procedures performed for percutaneous transluminal coronary angioplasty (PTCA), and coronary artery bypass graft (CABG) were also obtained. The live discharge of IHD, PTCA, or CABG formed the denominator of all clinically eligible patients. Only discrete counts (nonduplicate) were requested. Only patients who lived within the city of Saskatoon were included. The geographic size of Saskatoon is 10 km (east to west) by 12 km (north to south).

Postal code information from the 2011 census was used to identify 6 existing residential neighbourhoods in the city of Saskatoon that were defined as low income cutoff

1.58; IC à 95 %, 1,39-1,71) de participer à la RC que les patients des quartiers à revenu élevé. Parmi ceux qui y participaient, 66,7 % ont abandonné avant la fin du programme. Les participants des quartiers à faible revenu étaient plus susceptibles (RIA, 1,38; IC à 95 %, 0,57-3,50) de ne pas achever la RC. Au total, seulement 4,2 % des patients hospitalisés pour une CI, une ACTP ou un PAC commençaient et achevaient la RC. L'élargissement de l'accès à ceux qui vivent dans des quartiers à faible revenu n'accroissait pas les taux de participation (RIA, 1,31; IC à 95 %, 0,79-2,19) ou d'achèvement (RIA, 1,25; IC à 95 %, 0,23-2,41) à un niveau significatif.

Conclusions : Des taux élevés de non-participation et d'abandon de la RC étaient observés. Le fait de vivre dans un quartier à faible revenu était associé à des taux de participation et d'achèvement plus faibles. L'élargissement de l'accès à la RC n'a pas accru la participation ou la l'achèvement chez les patients des quartiers à faible revenu à un niveau significatif.

neighbourhoods by Statistics Canada. All 6 neighbourhoods were touching or contiguous pre-existing municipal boundaries. A neighbourhood is designated low income when more than 30% of the families within the neighbourhood meet the definition of the low-income cutoff. A family is designated low income when they spend more than 70% of family income on basic necessities like food, shelter, and clothing. Cutoff points are adjusted for family size, population of city or area of residence, urban/rural differences, and consumer price index.⁹

Health care utilization information in the province of Saskatchewan includes location of patient residence by postal code. As such, health care utilization information was collected on residents that lived in the 6 low-income neighbourhoods (n = 18,228). Two comparison groups were established. The first comparison group was all other Saskatoon residents (n = 184,284). The second comparison group was the 5 most affluent neighbourhoods in Saskatoon identified by Statistics Canada census information. The 5 neighbourhoods in the affluent group were also contiguous municipal boundaries and had similar population size (n = 16,683) as the 6 low-income neighbourhoods.⁹ The Saskatoon Health Region regularly uses these neighbourhood boundaries for health care delivery programming and evaluation.¹⁰

Analysis

Attendance and completion of CR was obtained and then stratified by the 3 neighbourhood income groupings. Attendance was defined as presenting to the initial 2-day education session. Attendance rates were adjusted for sex and age by taking 5-year interval stratum from the census, calculating stratum-specific rates, calculating expected rates among a standard population, adding all cases in the standard population, and then dividing it by the total standard population to calculate direct standardized rates. Noncompletion was defined as quitting and not returning to the requested 1 exercise session per week (52 weeks in total) within 1 year of program entry.

In January of 2009, the Saskatoon Health Region expanded its CR program to a second location on the perimeter of the 6 low-income neighbourhoods and notified every clinically eligible patient of the new option during the

initial telephone call. No other new initiative was used to improve attendance or completion rates. As such, attendance and completion of CR was reviewed among clinically eligible patients of the 6 low-income neighbourhoods in response to improved access. No other factor that could affect outcome was evaluated other than access (although the analysis was adjusted for age and sex).

The CR program in Saskatoon is 2 full days of education followed by monitored exercise sessions 1 day per week for 1 year and is offered to patients hospitalized for IHD, PTCA, or CABG. There is no user fee for the program, there is no waiting list, and the program is underutilized. The expansion to a second location was in partial response to a major Saskatoon Health Region report documenting significant disparity in health outcomes and access to health services for residents living in low income neighbourhoods.^{9,10}

Data were deidentified. The project was designated a health quality improvement initiative of a regular service and, as such, ethics approval was not required.

Results

During the 5-year study period from 2007 to 2011, there were 9490 discrete hospitalizations for IHD, PTCA, or CABG in the city of Saskatoon, Canada. With a denominator of 219,195, 4.3% of all clinically eligible residents were hospitalized for IHD, PTCA, or CABG. According to neighbourhood, 5% of clinically eligible residents of low-income neighbourhoods were hospitalized (904/18,228) compared with 4.4% of clinically eligible residents from all other neighbourhoods (8054/184,284) and 3.2% clinically eligible residents of high-income neighbourhoods (532/16,683). Clinically eligible residents from low-income neighbourhoods were more likely (odds ratio [OR], 1.58; 95% confidence interval [CI], 1.42-1.77; $P = 0.001$) to be hospitalized for IHD, PTCA, or CABG than clinically eligible residents from high-income neighbourhoods. After adjustment for sex and age, clinically eligible residents from low-income neighbourhoods were even more likely (OR, 1.76; 95% CI, 1.60-1.94; $P = 0.001$) to be hospitalized for IHD, PTCA, or CABG than clinically eligible residents from high-income neighbourhoods.

We then separated IHD hospitalizations from PTCA and CABG procedures. For IHD alone, 2.9% of all clinically eligible residents were hospitalized (6336/219,195). According to neighbourhood, 3.9% of clinically eligible residents of low-income neighbourhoods were hospitalized for IHD (720/18,228) compared with 2.9% for clinically eligible residents of all other neighbourhoods (5256/184,284) and 2.2% for clinically eligible residents of high-income neighbourhoods (360/16,683). Clinically eligible residents of low-income neighbourhoods were more likely (OR, 1.86; 95% CI, 1.64-2.12; $P = 0.001$) to be hospitalized for IHD than clinically eligible residents from high-income neighbourhoods. After adjustment for sex and age, clinically eligible residents of low-income neighbourhoods were even more likely (OR, 2.06; 95% CI, 1.84-2.30; $P = 0.001$) to be hospitalized for IHD than clinically eligible residents from high-income neighbourhoods.

We then reviewed attendance of CR. In total, 14.9% of those hospitalized for IHD, PTCA, or CABG attended any

component of CR (1418/9490). According to neighbourhood, 7.6% of clinically eligible residents from low-income neighbourhoods attended any component of CR (69/904) compared with 15.5% for all other clinically eligible residents (1250/8054) and 18.6% for clinically eligible residents of high-income neighbourhoods (99/532). Clinically eligible residents of low-income neighbourhoods were more likely (OR, 1.64; 95% CI, 1.50-1.74; $P = 0.000$) to not attend any component of CR than clinically eligible residents of high-income neighbourhoods.

The exercise component of CR is known to be the most effective so we reviewed attendance of the exercise sessions. In total, 12.7% of those hospitalized for IHD, PTCA, or CABG and eligible for CR attended the exercise component of CR (1204/9490). According to neighbourhood, 6.4% of clinically eligible residents of low-income neighbourhoods attended the exercise component of CR (58/904) compared with 13.2% for all other clinically eligible residents (1061/8054) and 16% for clinically eligible residents of high-income neighbourhoods (85/532). Clinically eligible residents of low-income neighbourhoods were more likely (OR, 1.64; 95% CI, 1.49-1.75; $P = 0.000$) to not attend the exercise component of CR than clinically eligible residents of high-income neighbourhoods. After sex and age adjustment, clinically eligible residents of low-income neighbourhoods were still less likely (OR, 1.58; 95% CI, 1.39-1.71; $P = 0.000$) to attend the exercise component of CR than clinically eligible residents of high-income neighbourhoods.

Mean duration from hospital discharge to attendance of CR was 123.2 days (SD, 277.2) for clinically eligible residents of the low-income neighbourhoods and 87.2 days (SD, 193.1) for the high-income neighbourhoods ($P = 0.57$).

We then reviewed completion rates of the exercise component of CR. Overall, 66.7% dropped out of the program before completion (803/1204). According to neighbourhood grouping, 62.1% of participants of low-income neighbourhoods were nonadherent to the exercise component of CR (36/58) compared with 67.3% for all other participants (714/1061) and 62.4% for participants of high-income neighbourhoods (53/85). There was no baseline difference in completion rate between participants of low-income and high-income neighbourhoods (OR, 0.99; 95% CI, 0.50-1.97; $P = 0.97$). However, after adjustment for age and sex, participants from low-income neighbourhoods were more likely (OR, 1.38; 95% CI, 0.57-3.50) to not complete CR.

In total, only 4.2% of those hospitalized for IHD, PTCA, or CABG started and completed exercise-based CR (401/9490). The results according to neighbourhood grouping are presented in [Table 1](#).

In 2007 and 2008 (pre-expansion to second location), 6.5% of clinically eligible residents living in low-income neighbourhoods attended any component of CR (25/382, with 18 attending exercise and 7 attending education). From 2009 to 2011, 8.4% of clinically eligible residents of low-income neighbourhoods attended any component of CR (44/522, with 40 attending exercise and 7 attending education). Comparing attendance before and after introduction of the second location, attendance did not increase to a level of significance (OR, 1.31; 95% CI, 0.79-2.19; $P = 0.30$). In comparison, the attendance rate increased over the same time

Table 1. Attendance and completion of CR by neighbourhood income

	Saskatoon overall	Six contiguous low-income neighbourhoods	All non-low-income neighbourhoods	Five contiguous affluent neighbourhoods
Hospitalizations for IHD, PTCA, and CABG	9490	904	8054	532
Attendance of exercise-based CR	12.7%	6.4%	13.2%	16.0%
Noncompletion of exercise-based CR	66.7%	62.1%	67.3%	62.4%
Attendance and completion of exercise-based CR	4.2%	2.4%	4.3%	6.0%

CABG, coronary artery bypass graft; CR, cardiac rehabilitation; IHD, ischemic heart disease; PTCA, percutaneous transluminal coronary angioplasty.

period in high-income neighbourhoods (OR, 1.80; 95% CI, 1.12-2.91; $P = 0.015$).

In 2007 and 2008, 66.7% of CR participants residing in low-income neighbourhoods did not complete the exercise component of CR (12/18). From 2009 to 2011 (after expansion), 54.5% of CR participants of low-income neighbourhoods did not complete the exercise component of CR (24/50). Comparing before and after change, the second location did not increase completion rates to level of significance (OR, 1.25; 95% CI, 0.23-2.41; $P = 0.78$). In contrast, completion rates increased over the same time period in high-income neighbourhoods (OR, 5.40; 95% CI, 1.45-20.10; $P = 0.001$; Fig. 1).

Discussion

Despite known benefits to patients attending CR programs, we found low enrollment and completion rates in Saskatoon, Canada.

In our study, 14.9% of those hospitalized for IHD, PTCA, or CABG attended any component of CR and 12.7% attended exercise-based CR. This is similar but slightly worse than a review that found that a third of eligible patients attend

CR across jurisdictions.⁴ Residents of low-income neighbourhoods were 58% less likely to attend CR than residents of high-income neighbourhoods. Although this finding is new, it is consistent with reviews that found that another socioeconomic indicator, lower educational status, had a negative effect on attendance of CR.^{4,5} Residents of low-income neighbourhoods might have a lower health literacy level which limits their ability to recognize the importance of attending CR to lower cardiovascular risk.¹¹ Additionally, these patients might suffer from more barriers to attend CR such as lack of transportation, access, and less social support.¹²

Among those who originally attended exercise-based CR, 66.7% quit before program completion. This is the same as in a review that found that two-thirds of those who originally enrolled did not complete CR.⁴ Noncompletion by level of income is a new finding for CR but consistent with the literature. For example, a meta-analysis reviewing adherence to chronic disease medications found that income was a strong predictor.¹³

In total, only 4.2% of those hospitalized for IHD, PTCA, or CABG started and completed exercise-based CR. We believe that attendance and completion is a central component of rehabilitation that is too often ignored. Understanding

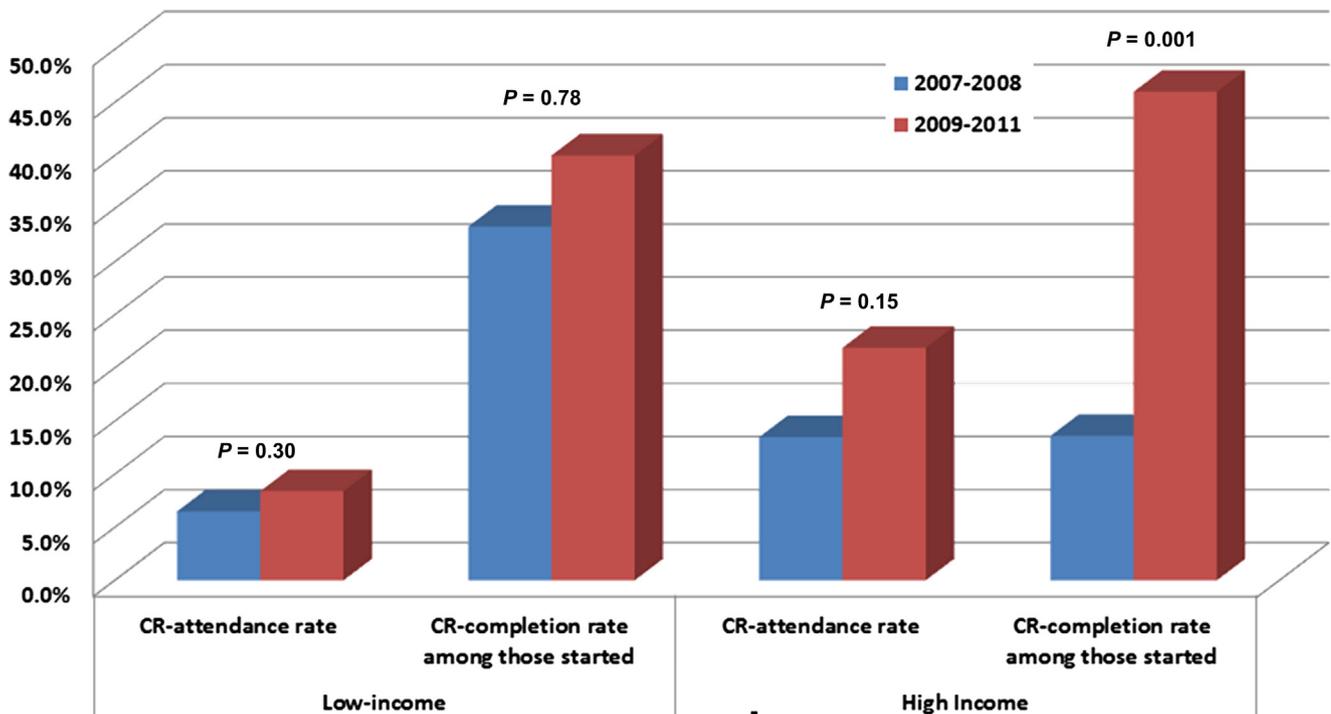


Figure 1. Attendance and completion of exercise-based cardiac rehabilitation (CR) according to neighbourhood income before (July 2008) and after (September 2011) the second CR location in a low-income neighbourhood. The second CR location did not increase attendance in low-income residents.

differences in attendance and completion rates among residents according to neighbourhood income could help CR staff to improve support to patients who need it.

Expanding access to CR did not increase attendance and completion rates among clinically eligible residents of low-income neighbourhoods to levels of statistical significance. This is not consistent with the recommendations of a meta-analysis: interventions that remove barriers identified by patients, like access, will increase attendance and completion rates.⁷ However, the results are similar to a study that found that geography did not influence access to revascularization procedures among those with lower socioeconomic status.¹⁴

The study has a number of limitations. First, it is a retrospective review and not a prospective, randomized trial. Second, the denominator is based on previous hospitalization for IHD, PTCA, or CABG. This could be an underestimate if other diseases are considered appropriate for CR (ie, I10-I15, hypertensive diseases) or an overestimate if not all cases of IHD, PTCA, or CABG are appropriate for referral.⁸ Third, the definition of noncompletion is for 1 year without information of when noncompletion actually occurred. Fourth, caution is recommended in the interpretation of intervention results because the sample size was very limited.

In summary, high rates of nonattendance and non-completion of CR were observed. Living in a low-income neighbourhood had a negative effect on initial attendance and completion. Expanding access to CR did not increase attendance and completion among residents of low-income neighbourhoods to a significant level.

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Disclosures

The authors have no conflicts of interest to disclose.

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