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ARTICLE

Psychosocial Factors and the Risk of Type 2 Diabetes Mellitus in Women Population based Epidemiological Study

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ABSTRACT

Our aim was to study the effect of depression and social support on the risk of type 2 diabetes in female population aged 25-64 in Russia / Siberia. Under the screening surveys random representative samples of women aged 25-64 years were examined in 1994 and 2005. Depression assessment was performed using the MONICA- MOPSY test. Social support was measured using the Berkman-Sim test. From 1994 to 2018 in a cohort of women new-onset cases of diabetes mellitus were detected. The risk of T2DM in persons with depression was 1.844 ($p<0.01$). After adjusting for socio-demographic variables, the risk decreased by 6% but remained significantly significant ($p <0.05$). The impact of a low level of social relations showed a significant effect on the risk of diabetes mellitus, including the multivariate model adjusted for the social gradient (HR=1.833, $p<0.05$). The presence of psychosocial factors decreases the protective effect of education in diabetes incidence. The incidence of T2D was higher in the group of manual labor and in executives. Depression and low social support increase the risk of T2DM by 80%. The frequencies of T2DM are determined by the social gradient and are associated with the role conflict "family-work".

1. Introduction

The prevalence of type 2 diabetes mellitus (T2DM) is increasing annually in Russia. According to the 'State Register of Diabetes', it is estimated 3,000 per 100,000 of the population in the Siberian Federal District [1]. The WHO statement, that 9.6% of women aged 25 years and older with diagnosed diabetes T2DM in the European region, illustrates the global concern and the lack of effectiveness in risk management. The identification of new risk factors for T2DM and the search for ways to manage these factors is another challenge to the scientific community.

In a number of studies the growing interest in depression (D), as a new risk factor for T2DM, demonstrates the prognostic impact of depression in developing type 2 diabetes. It was detected that T2DM is often combined with D in a number of studies. They are mainly carried out in

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groups of patients, and the cross-sectional design may also make it difficult to establish, 'Which came first: diabetes mellitus or depression?' However, the first epidemiological studies on the impact of D on the risk for T2DM were limited to a male sample [2] or based on diabetes reported by the respondents that was not confirmed by any other methods [3]. The importance of social support (SP) in the control / management of T2DM is widely recognized [4]. But the effect on glycemic control remains unclear. SP is a multidimensional quantity associated with individual perceptions and receiving support from their family, friends, etc., traditionally identified by two indicators: level of close contacts and social networking development [5]. In this case, the positive impacts or lack of support leading to social isolation have a direct or indirect effect on health, for example, through health-related behavior.

In general, women with a low level of social support are characterized by a more unfavorable lifestyle than people with a high level of SP. Such women smoke more, pay less attention to physical activity, and less often measure blood pressure [6]. It is worth noting that such a negative component of SP as loneliness leads to high rates of depressive symptoms in women [7]. At the same time, social support can reduce the influence of negative psychosocial characteristics, for instance, hostility or D symptoms on aggressive behavior towards health (smoking, alcohol, nutrition) [8,9].

The frontiers of research on impact of psychosocial factors (PSF) on the risk for T2DM are restricted by the classical epidemiological approaches, which are significant moderators of heterogeneity of results. Therefore, our objective was to study the prevalence and evaluate the impact of depression and social support on the risk of developing type 2 diabetes in the open population among women.

2. Materials and Methods

2.1. Study Design

The results of our study were obtained from the survey of the female population living in one of the districts in Novosibirsk. The screening examinations were performed at the Research Institute of Therapy and Preventive Medicine - a branch of the ICG SB RAS 1994-95 and 2003-2005 (scientific topic # AAAA-A17-117112850280-2). Samples were generated independently for each of the epidemiological programs, according to the requirements of protocol. Screening among female population in 1994-95 and 2003-2005 was conducted under the WHO MONICA-MOPSY program (Multinational Monitoring of Trends and Determinants of Cardiovascular Disease - Optional Psychosocial Substudy). Quality assurance was carried out at the MONICA quality control centers: Dundee (Scotland), Prague (Czech Republic), Budapest (Hungary). The presented results were found satisfactory [10].

2.2 Participants

As part of the screening in 1994-95, 870 women aged 25-64 years were examined, the average age was 45.4 + -0.4 years [10]. The sample was generated using the electoral lists and a table of random numbers of 300 people in each age group (total - 1,200 people). The mechanical random sampling procedure was used. The response screening is 72.5%. In 2003-2005 the people aged 45-69 years were examined in the same district of the city (women - n = 1294, average age - 54.27 + -0.2 years, response - 72%). Subsequently, women over 64 were excluded from the analysis.

Of all people examined, a cohort study was designed in 1994-5 and 2003-5. 1619 women aged 25-64 years with completed questionnaires for depression and SP were included in the analysis after excluding from the study all women with T2DM that occurred prior to screening or identified by screening. The follow-up period, on average, was 15 years.

2.3 Outcome Measures

The substantive outcomes reported in this study were incidence of type 2 diabetes mellitus. All incidence of diabetes were recorded based on cohort study (screening, medical records, autopsy protocols), as well as using the WHO epidemiological program 'Register of acute myocardial infarction'. 134 incdent cases of type 2 diabetes mellitus were diagnosed according to the ICD-10 classification from 1994 to 2018. Other types of diabetes were not considered and were not included in the analysis. Taking hypoglycemic drugs was not taken into account, either.

2.4. Psychosocial Factors Measures

The WHO MONICA-MOPSY (Multinational Monitoring of Trends and Determinants of Cardiovascular Disease - Optional Psychosocial Substudy) program was used to measure psychosocial factors [10]. To evaluate depression, we used the form of the depression scale - the MOPSY test (Depression Scale), consisting of 15 questions. For each question there are 2 answers given: 'agree', 'disagree'. The severity of depression was assessed as no depression (No D), moderate (Mod. D), major (Major D). Social support was measured using the Berkman-Sim test [5]; The Close Contact Index (ICC) and Social Relations Index (SNI) were taken into account. ICC

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levels were rated as high, medium, low; SNI - high, mid-1, mid-2, low.

2.5. Other Social Factor Measurements

Social and demographic indicators were registered. Marital status: single, married, divorced, widowed. The level of education was evaluated as: higher, incomplete higher - secondary special, secondary, incomplete secondary - primary. The attitude to the professional group was evaluated as: (1) Executives. (2) Middle managers. (3) First-line managers. (4) Engineers, specialists. (5) Hard manual workers. (6) Moderate physical labor workers. (7) Easy manual workers. (8) Students. (9) Retired people. (10) Military personnel.

2.6. Statistical Analyzes

Statistical analysis was carried out with the SPSS (Statistical Package for the Social Science) software package, version 11.5. To test the statistical significance of differences between groups, the chi-square test (x^2) was used. A p-values ≤ 0.05 were considered statistically significant. Cox-proportional regression model (Cox-regression) was used to assess the relative risk of developing diabetes.

2.7. Ethical Expertise

This study has been approved by the Local Biomedical Ethics Committee (protocol No. 4 of 10/15/2009).

3. Results

The prevalence of D in the open population among women aged 25-64 years was found 54.6% (Major D - 11.8%) in 1994; in the age group 45-64 years, the frequency of D was 58.9% (Major D - 11.5%). At a screening in 2003-2005, among women aged 45-64 years, the frequency of D was 36.4% (Major D - 4.7%). In the studied cohort among people with T2DM, the frequency of D was higher and estimated 51.3%.

Table 1. The prevalence of depression in the open population among women aged 25-64 years

	Screening 1994-1995 yy										Screening 2003-2005 yy					
	25-34 yy		35-44 yy		45-54 yy		55-64 yy		25-64 yy		45-54 yy		55-64 yy		45-64 yy	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Major D [1]	10	9,7	18	13,6	1	2,9	8	18,6	37	11,8	28	5,1	22	4,2	50	4,7
Mod. D [2]	44	42,7	53	40,2	17	48,6	20	46,5	134	42,8	179	32,3	161	31	340	31,7
No D [3]	49	47,6	61	46,2	17	48,6	15	34,9	142	45,4	347	62,6	337	64,8	684	63,7
Total	103	100	132	100	35	100	43	100	313	100	554	100	520	100	1074	100
	p for all <0.05															

Notes:
[1] Major D - major depression; [2] Mod. D - moderate depression; [3] No D - no depression

The prevalence of social support was as follows. The proportion of low and average ICC in the open population among women aged 25-64 was 56.8% and 36.9%, respectively, in 1994; in the age group of 45-64, low ICC was found in 54.2% of women. The screening results in 2003-2005 among women aged 45-64 show that the incidence of low and average ICC was 51.1% and 43.9%, respectively. In a cohort of women with advanced type 2 diabetes, the frequency of low ICC was even higher and estimated 55.8%.

Table 2. The prevalence of levels of close contact in the open population among women aged 25-64 years

	Screening 1994-1995 yy										Screening 2003-2005 yy					
	25-34 yy		35-44 yy		25-34 yy		35-44 yy		25-34 yy		35-44 yy		25-34 yy		35-44 yy	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Low ICC [1]	82	57,7	86	60,6	72	54,1	71	54,2	311	56,8	298	53,8	251	48,3	549	51,1
Average ICC [2]	50	35,2	45	31,7	52	39,1	55	42	202	36,9	231	41,7	240	46,2	471	43,9
High ICC [3]	10	7	11	7,7	9	6,8	5	3,8	35	6,4	25	4,5	29	5,6	54	5
Total	142	100	142	100	133	100	131	100	548	100	554	100	520	100	1074	100
	n.s.								p<0.001		p<0.05		n.s.			

Note:
[1] Low ICC - low index of close contacts; [2] Average ICC - average index of close contacts; [3] High ICC - high index of close contacts

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The share of low SNI (combined low and average-1) in the open population among women aged 25-64 was 77.1%, average-2 SNI - 20.3%, respectively, in 1994; in the age group 45-64 years, low ICC was found in 76.5% of women. The screening results in 2003-2005 among women aged 45-64 show that the incidence of low and average SNI was 80.1% and 17.4%, respectively. Among women with advanced type 2 diabetes, the incidence of low SNI was even higher and estimated 87%.

Table 3. The prevalence of levels of social network in the open population among women aged 25-64 years

	Screening 1994-1995 yy										Screening 2003-2005 yy					
	25-34 yy		35-44 yy		25-34 yy		35-44 yy		25-34 yy		35-44 yy		25-34 yy		35-44 yy	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
low SNI [1]	47	33,1	56	39,4	47	35,3	36	27,5	186	33,9	143	25,8	133	25,6	276	25,7
Average - 1 SNI [2]	64	45,1	54	38	57	42,9	62	47,3	237	43,2	301	54,3	283	54,4	584	54,4
Average - 2 SNI [3]	28	19,7	29	20,4	23	17,3	31	23,7	111	20,3	97	17,5	90	17,3	187	17,4
High SNI [4]	3	2,1	3	2,1	6	4,5	2	1,5	14	2,6	13	2,3	14	2,7	27	2,5
Total	142	100	142	100	133	100	131	100	548	100	554	100	520	100	1074	100
	p<0.01		n.s.		n.s.		p for all <0.001				n.s.					

Notes:
[1] Low SNI - low social network index; [2] Average - 1 SNI - average-1 social network index; [3] Average - 2 SNI - average-2 social network index; [4] High SNI - high social network index

The relationship between PSF and the social characteristics of women and the development of T2DM was studied.

The structure of marital status in a cohort of women with developed T2DM and D was as follows: single – 4%; married – 72%; divorced and widowed –12% (x^2 = 14.610 df = 3 p <0.001). In the presence of D, the proportion of individuals with T2DM was statistically significantly higher among married women (x^2 = 11.362 df = 1 p <0.001), divorced (x^2 = 6.417 df = 1 p <0.05) and widowed (x^2 = 5.324 df = 1 p <0.05) compared with single women, where the incidence of T2DM was higher among individuals without D (4% and 34%, respectively).

The structure of educational level among people with T2DM and D was: higher education - 38%; incomplete higher education / college - 24%; high school - 26% and primary education - 12% (p> 0.05). The trends (p> 0.05) in the increased frequency of T2DM among people with D and higher and primary education are detected; the frequency of T2DM in women with specialized secondary education and high school is higher among the people without D.

Professional status in groups of women with T2DM and D indicated the followings: 6% - executives; 12% - middle manager; 14% - first-line managers; 16% - engineers, specialists; 10% - hard manual workers; 8% - moderate physical labor workers; 14% - easy manual workers; 18% - retired people; 2% - military personnel and persons assimilated thereto (p> 0.05). A significant increase was found in the proportion of hard manual workers among people with D and T2DM compared with a group of women without diabetes (10% and 0.9%, respectively; x^2 = 4.375 df = 1 p <0.05). Developed T2DM is associated with a reduction in the cumulative share of managers at all levels in the presence of depression from 51.1% (No D) to 32% (with D), and an increase in the share of manual workers from 14.9% (No D) to 32% (with D) (x^2 = 3.993 df = 1 p <0.05).

The structure of marital status in a cohort of women with advanced T2DM and low ICC was as follows: single - 23.5%; married - 42.6%; divorced - 19.1% and widowed - 14.7% (x^2 = 29.936 df = 3 p <0.001). As in the group without diabetes, the proportion of married women with T2DM with a decrease in the index of close contacts was significantly reduced. However, people with advanced diabetes this decrease is less pronounced - from 88.9% (average and higher ICC) to 26% (low ICC) for people without diabetes, and up to 42.6% (low ICC) for people with type 2 diabetes (x^2 = 6.504 df = 1 p <0.05). The incidence of T2DM in the presence of low ICC is higher among single (x^2 = 13.371 df = 1 p <0.001), divorced (x^2 = 14.951 df = 1 p <0.001) and widowed (x^2 = 4.223 df = 1 p <0.05) than at a higher ICC compared to married ones.

The structure of educational level among people with T2DM and low ICC was: higher education - 38.2%; incomplete higher education / college - 17.6%; high school - 29.4% and primary education - 14.7% (p> 0.05). The trends (p> 0.05) in the increased frequency of T2DM among people with a low ICC compared with a higher ICC for all categories of education are detected, except for the people with specialized secondary education, where the trend reverses.

Professional status in groups of women with T2DM and low ICC indicated the followings: 3.1% - executives; 15.6% - middle managers; 18.8% - first-line managers; 7.8% - engineers, specialists; 4.7% - hard manual workers; 6.3% - moderate physical labor workers; 10.9% - easy

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manual workers; 31.3% - retired people; 1.6% - military personnel and assimilated thereto (p> 0.05). The proportion of retired people with low ICC and T2DM was higher than in other professional categories, but only in comparison with engineers and specialists reached statistical significance (χ^2 = 3.944 df = 1 p <0.05).

The structure of marital status in a cohort of women with advanced T2DM and low SNI was as follows: single - 16%; married - 59.4%; divorced and widowed - 12.3% (p> 0.05). As in the group without diabetes, the proportion of married women with T2DM significantly reduced with a decrease in the index of social connectedness (χ^2 = 4.329 df = 1 p <0.05), in other categories of marital status, on the contrary, it increased.

The structure of educational level among people with T2DM and low SNI was: higher education - 35.8%; incomplete higher education / college - 23.6%; high school - 27.4% and primary education - 13.2% (p> 0.05). The trends (p> 0.05) in increased frequency of T2DM among people with low SNI compared with a higher SNI for high school education.

Professional status in groups of women with T2DM and low SNI indicated the followings : 4.9% - executives; 15.7% - middle managers; 16.7% - first-line managers; 10.8% - engineers, specialists; 5.9% - hard manual workers; 8.8% - moderate physical labor workers; 8.8% - easy manual workers; 26.5% - retired people; 2.0% - military personnel and persons assimilated thereto (p> 0.05). The presence of T2DM is associated with an increase in the proportion of managers at all levels among people with low SNI to 37.3% (with a favorable SNI of 18.8%), while in the absence of diabetes, the trend reverses (χ^2 = 4.413 df = 1 p <0.05)

The risk of T2DM in individuals with depression was determined to be 1.844 (95% CI 1.238-2.746, p <0.01). After standardization by age, the risk decreased by 21%, but still remained significant and estimated 1.633 (95% CI 1.083-2.461, p <0.05). The inclusion of social characteristics in a multivariate model, such as marital status (reference category 'married'), educational level (reference category 'higher'), and professional status (reference category 'executive') increased the risk of T2DM by 1.781 times in people with D (tab. 4), compared with those ones who did not have D (95% CI 1.173-2.706, p <0.01).

Table 4. The risk of type 2 diabetes mellitus depending on the level of depression, age and social characteristics in the female population aged 25-64 years

	B 1	SE 2	Wald 3	df 4	Sig.5	Exp(B) 6	95,0% CI 7 for Exp(B)	
							Lower	Upper
Depression	,577	,213	7,330	1	,007	1,781	1,173	2,706
25-34 years 8			23,394	2	,000			
45-54 years	-2,351	,511	21,201	1	,000	,095	,035	,259
55-64 years	-2,487	,518	23,031	1	,000	,083	,030	,230
Married 9			1,184	3	,757			
Single	,283	,273	1,071	1	,301	1,327	,777	2,266
Divorced	,277	,411	,454	1	,500	1,319	,589	2,953
Widowed	,123	,402	,094	1	,760	1,131	,515	2,484
University 10			3,566	3	,312			
College	-,260	,282	,845	1	,358	,771	,444	1,341
High School	,236	,302	,609	1	,435	1,266	,700	2,290
Elementary	,376	,490	,589	1	,443	1,457	,557	3,810
Executives 11			11,946	9	,216			
MidManagers12	,298	,513	,336	1	,562	1,347	,493	3,683
Managers 13	,174	,517	,114	1	,736	1,190	,432	3,278
Engineers	-,286	,546	,275	1	,600	,751	,257	2,192
Easy Manual	,782	,683	1,310	1	,252	2,186	,573	8,336
Mod. Manual 14	-,129	,631	,042	1	,838	,879	,255	3,031
Hard Manual	-,604	,615	,965	1	,326	,547	,164	1,824
Students	-9,800	214,802	,002	1	,964	,000	,000	3,836
Retired	,333	,535	,388	1	,533	1,395	,489	3,978
Military	-,886	1,109	,638	1	,425	,412	,047	3,626

Notes:

[1] B - regression coefficient; [2] SE - standard error; [3] Wald - Wald criterion; 4 df - number of degrees of freedom; [5] Sig. - statistical significance; [6] Exp(B) - B exponent; [7] CI - confidence interval; [8] Age groups; [9] Marital status; [10] Educational level; [11] Occupation; [12] MidManagers - Middle managers; [13] Managers - First-line managers; [14] Mod. Manual - Moderate physical labor workers

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The impact of social support has displayed an array of results. So, in the one factor model, the low close contact index - ICC indicated only the risk trend for T2DM (HR = 1.208 95% CI 0.845-1.727, p> 0.05) compared with people with a higher (good + average) level of close contacts. The correction for social variables in the multivariate model increased the risk of T2DM with a low ICC by 29%, but the significance of the results was higher than the confidence threshold (p> 0.05). Standardization by age indicated a lack of significant results.

But the influence of a low level of social connectedness (SNI, where low and average-1 is combined into the "low" category) indicated a significant effect on the risk of T2DM (HR = 1.713 95% CI 1.012-2.897, p <0.05). In a multifactor model with an indicator of social connectedness, the addition of social characteristics explained a 12% increase in the risk of T2DM in people with an undeveloped social network compared to a good SNI index (Table 5), while the results remained significant (HR = 1.833 95% CI 1.064-3.158, p <0.05).

Table 5. The risk of type 2 diabetes mellitus depending on the level of social connectedness and social characteristics in the female population aged 25-64 years

	B [1]	SE [2]	Wald [3]	df [4]	Sig.[5]	Exp(B) [6]	95,0% CI [7] for Exp(B)	
							Lower	Upper
Low SNI [8]	,606	,277	4,773	1	,029	1,833	1,064	3,158
Married [9]			4,799	3	,187			
Single	-,585	,267	4,787	1	,029	,557	,330	,941
Divorced	-,121	,310	,152	1	,697	,886	,483	1,626
Widowed	-,096	,298	,104	1	,748	,909	,507	1,629
University [10]			22,573	3	,000			
College	-,331	,267	1,537	1	,215	,718	,426	1,212
High School	,183	,282	,421	1	,517	1,201	,691	2,088
Elementary)	1,296	,355	13,354	1	,000	3,654	1,824	7,320
Executives [11]			9,968	9	,353			
MidManagers[12]	,344	,509	,457	1	,499	1,411	,520	3,826
Managers [13]	,291	,513	,322	1	,570	1,338	,489	3,662
Engineers	,049	,529	,008	1	,927	1,050	,372	2,960
Easy Manual	1,240	,643	3,718	1	,054	3,454	,980	12,179
Mod. Manual [14]	,452	,578	,613	1	,434	1,572	,507	4,874
Hard Manual	-,097	,569	,029	1	,864	,907	,298	2,765
Students	-9,246	210,023	,002	1	,965	,000	,000	5,710
Retired	,518	,511	1,028	1	,311	1,678	,617	4,565
Military	-,090	,849	,011	1	,915	,914	,173	4,820

Notes:
[1] B - regression coefficient; [2] SE - standard error; [3] Wald - Wald criterion; 4 df - number of degrees of freedom; [5] Sig. - statistical significance; [6] Exp(B) - B exponent; [7] CI - confidence interval; [8] Low SNI - low social network index; [9] Marital status; [10] Educational level; [11] Occupation; [12] MidManagers - Middle managers; [13] Managers - First-line managers; [14] Mod. Manual - Moderate physical labor workers

The addition of an age correction to the multivariate model reduced the reliability of the results, but the tendency for risk of T2DM in individuals with low SNI still remained (HR = 1.674 95% CI 0.967-2.895, p = 0.066)

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(Figure 1).

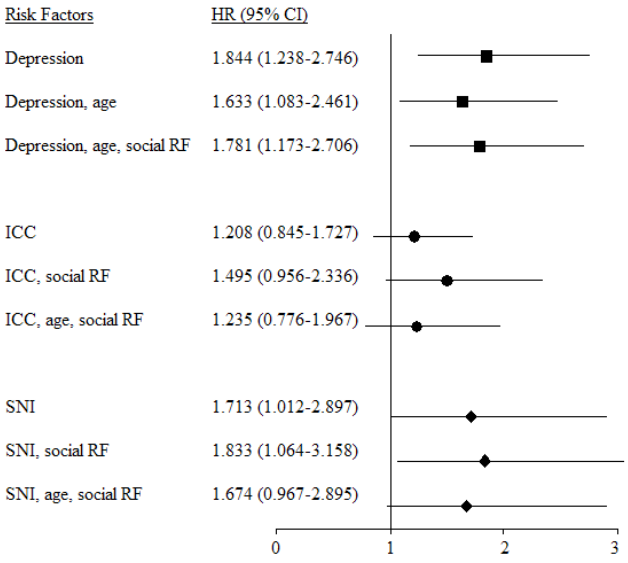

Figure 1. Psychosocial factors and risk of T2DM in female population of 25-64 years: D - depression; ICC - index of close contacts; SNI - social network index; Social RF - social risk factors

4. Discussion

This study showed a high prevalence of D and low SP among the female population. From the example of the female part of the urban population in Russia, the impact of depression and low SP on the risk of T2DM was first detected using classical epidemiological approaches.

The prevalence of D in the open population among women aged 25-64 years was 54.6% in 1994, the frequency of Major D was 11.8%; in 2005 - 36.4% (Major D - 4.7%). The decrease in the frequency of D in the age groups 45-64 years by 2005 does not contradict the global trend in increasing D, where this growth is provided by the youngest (18-25 years old) and older (> 65 years old) age groups [11]. It should be noted that the prevalence of Major D in Russia / Siberia is lower than in high-income countries such as France - 20%, the Netherlands - 17.9% or the USA - 19.2%, and is comparable to countries with lower middle income, where the frequency of Major D is, on average, 11.1% [12].

Considering the concept of health as a set of biological, psychological, social, cultural, economic and spiritual factors, it should be recognized that the sphere of mental health is not a simple biological or psychological aspect of it, which has a social dimension and nature. SP is such a value, which plays an important part in the creation, maintenance and health promotion, as well as in the incidence of chronic non-communicable diseases [5].

No significant dynamics was found in the prevalence of SP from 1994 to 2005: low levels of close contacts, on average, was 53%, and social connectedness - 79%. Thus, more than half of the female population in Russia had an unfavorable level of social support. This part of the female population facing with stressful events is deprived of physical and psychological benefits which provides tangible support, and unable to cope with the consequences of psychological distress [13].

The high correlation of PSF with socio-demographic variables, both according to our previous studies and other researchers, is related to the need to include in the model an adjustment for such variables as marital status, education, professional status [5].

The family environment changes the level of close contacts in people with and without diabetes. Our results indicate that married women are more likely to have higher ICC levels both among people with and without diabetes. This is due to the lack of significant results in the risk of developing T2DM in people with low ICC, in a multivariate model adjusted for social variables, where, among others, marital status was taken into account. At the same time, married women show a higher incidence of depression: among people with D and developing T2DM, the proportion of married women was 72%. These indicators are associated with family stress and the personal work-family conflict, which lead to adverse consequences for somatic health [14,15].

The results showed that the presence of D among women with higher and primary education increased the incidence of type 2 diabetes. A similar trend was indicated with a low level of ICC, which eliminates the protective effect of education at risk of developing diabetes. This reflects the independent impact of negative affective states on the risk of T2DM, confirmed in other cohort studies [3,16].

With regard to professional status, it was indicated that the incidence of T2DM was higher in the manual labor group in combination with D. With regard to social connections, on the contrary, diabetes was more common among women leaders and a low social network. Recent studies have shown an adverse impact of manual labor on the risk of developing T2DM among men, but not women [17,18]. And this connection can be weakened by traditional factors, such as obesity [18]. Our results fill this gap by representing management at high risk for diabetes. The higher prevalence of T2DM in the group of managers with low social integration, as well as physical labor in women with D, shows the vulnerability of these occupational categories to the risk of developing diabetes. The low-skilled labor in our recent studies, as well as the work-family conflict that characterizes managers, are the

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factors of higher psychosocial stress and, combined with PSF, are associated with the risk of serious cardiovascular catastrophes [5,15].

The increase in the risk of type 2 diabetes by 1.8 times among the female population with D underlines the importance of studying this psychological factor. The correction for socio-demographic indicators slightly reduced this risk, which demonstrates the independent effect of the presence of depression in the development of T2DM. Recent foreign studies confirm such conclusions [16, 19]. Possible mechanisms include the effect of D on behavioral aspects such as physical activity, diet, and adherence to prevention methods [20]. Biological mechanisms of influence include activation of the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system [21].

The influence of a low level of social connectedness showed a significant effect on the risk of developing T2DM, including in a multi-factor model adjusted for a social gradient. The information about the effect of SP on the risk of T2DM is limited in the available literature. Similar studies were performed in groups of patients with T2DM or had a cross-sectional design, or surrogate endpoints, such as glycated hemoglobin, were estimated [22-25]. One prospective design study published in 2019 had a similar design. For 14 years, American colleagues studied the effect of SP on the risk of T2DM in 139,924 women aged 50-79 years and obtained the similar results. They indicated that the risk of T2DM among women with high levels of SP is reduced, regardless of demographic and behavioral factors. The authors specify that indicators of social connectedness / interactions have a direct effect on the risk of T2DM, although they do not exclude an indirect effect through lifestyle and symptoms of depression [26].

Identifying the strengths and weaknesses of our study, we note that this study provided a single measurement of PSF in 1994 and 2005, followed by assessment of the effect such as risk factors. However, this is not a limitation, since American researchers (Carnethon M. et al.) proved the sustained effect of both the once recorded signs of D and the persistent form of D on the risk of T2DM, regardless of traditional factors: BMI, physical activity, smoking, etc. [27]. Our results fill a gap in epidemiological studies on the effect of PSF on the risk of T2DM. It makes it necessary to the assessment of nonconventional - psychosocial factors in addition to traditional risk factors of diabetes.

5. Conclusions

(1) It was estimated that the prevalence of depression in the open population among women aged 25-64 years in 1994 was 54.6% (Major depression - 11.8%); 45-64 years old- 58.9% (Major depression - 11.5%); in 2003-2005 aged 45-64 - 36.4% (Major depression - 4.7%). Among people with type 2 diabetes, the frequency of depression was higher and amounted to 51.3%.

(2) It was established that the proportion of the low index of close contacts in the open population among women aged 25-64 years was 56.8%; aged 45-64 - 54.2%. Among women with advanced type 2 diabetes mellitus, the frequency of low close contact index was 55.8%. The share of the low index of social connectedness was 77.1%; aged 45-64 - 80.1%. among women with type 2 diabetes mellitus, the incidence of a low index of social connectedness was 87%.

(3) The results show that the risk of type 2 diabetes mellitus in individuals with depression was significantly higher than without depression and amounted to 1.844 (95% CI 1.238-2.746, $p < 0.01$). After adjusting for socio-demographic variables, the risk decreased by 6%, but still remained significant ($p < 0.05$).

(4) It was indicated that a low level of social connectedness significantly affects the risk of developing type 2 diabetes mellitus, including in a multivariate model adjusted for social factors (HR = 1.833 95% CI 1.064-3.158, $p < 0.05$).

(5) We got proof that there is relationship between the social gradient and depression and type 2 diabetes mellitus among women: 1. the proportion of married women was 72%; 2. the presence of psychosocial factors mitigates the protective effect of education in the development of type 2 diabetes; 3. the frequency of type 2 diabetes was higher in the manual labor group in combination with D; 4. diabetes was more common among women leaders with a low social network.

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ARTICLE

Effectiveness of a Group Exercise Class vs. Home Exercise Program as a Follow-up to Physical Therapy for Older Adults with High Fall Risk

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ABSTRACT

This quasi-experimental study compared the results of a traditional model of physical therapy (PT) care to a PT wellness model known as GroupHab. The traditional model included discharge from PT with a home exercise program (HEP) to be self-administered with or without the addition of a community-based exercise program. The wellness model included participation in a PT-designed and supervised group exercise program (GroupHab class) in an outpatient clinical setting following discharge from PT. Independent t-tests were used to compare the number of falls, exercise frequency, and exercise duration between the two groups. A repeated measures, analysis of variance (RM-ANOVA) compared changes in balance confidence scores both within and between groups, and a multivariate analysis of variance (MANOVA) analyzed group differences across multiple quality of life ratings using the SF-20. All data were analyzed at the 0.05 alpha level using SPSS 24 statistical software. Our results showed a significantly greater reduction in recurrent falls among the GroupHab wellness group compared to the HEP group ($t=2.811$, $p=0.009$). The resulting odds ratio for subsequent falls was 2.2 among HEP participants and 0.2 among GroupHab participants. Exercise adherence was also greater for those who participated in the GroupHab class. They documented greater exercise frequency ($t= -3.253$, $p=0.002$) and more exercise minutes ($t= -7.188$, $p<0.001$) than those who participated in the HEP. When comparing changes in the participants' balance confidence, we found an average increase of 5% among GroupHab participants compared to a 6% decrease among HEP participants ($F=16.877$, $p<0.001$, power=0.981). Although our multivariate analysis of the SF-20 scores revealed no significant difference overall ($F=0.768$, $p=0.73$), the univariate analyses showed significantly greater improvements among GroupHab participants in selected areas of physical function. These results suggest that at-risk older adults who are discharged into a functionally-based group exercise class are less likely to experience recurrent falls and are more likely to have more confidence in their balance than those who are discharged with a standard HEP and/or use of community-based exercise classes.

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1. Introduction

Demographic projections have created an urgent need for changes in our approach to health care in the United States and elsewhere to stem the population health problems affecting older adults. In the U.S., longer lifespans are expected to dramatically increase this segment of the population [1] to approximately 20% by the year 2030.[2] Of this number, 85% will be managing a chronic health condition, and 60% will be managing two or more conditions.[2] Previous research has clearly established a relationship between these multiple co-morbidities, as well as the medications used to treat them, and the rise in unintentional falls among older adults. According to the National Council on Aging, every 11 minutes an older adult in the U.S. visits an emergency room for a fall-related injury, and every 19 minutes, an older adult dies from a fall. [3] Each year, approximately one-third of adults aged 65 years or older will fall and two-thirds of these individuals will fall repeatedly.[3] Falls continue to be a leading cause of injury-related death in this age group as well as a major cause of disabling injuries such as hip fractures and head trauma which increase the risk of early death. [3] Many people who fall, even those who are not injured, develop a fear of falling. [4] This fear tends to limit their physical activities which further reduces their strength, balance, and mobility, thus increasing their susceptibility to falling [4].

Regular physical activity (PA) is one of the most important things older adults can do for their health. There is strong evidence to support the prophylactic effect of regular PA on fall risk as well as many other age-related health problems. [2,5] However, many older adults avoid PA for a variety of reasons including physical limitations, lack of expert guidance and support, and inadequate information on available programs. [6,7] Even with exercise programs that are free or low cost (e.g., Silver Sneakers, Enhance Fitness) older adults are attending in very low numbers,[7] and those who are most vulnerable do not utilize these services at all [7].

The combination of falls and lack of PA creates a huge economic burden that includes the cost for emergency care, hospitalizations, rehabilitation, and long-term care. In the United States, treatment for this population accounts for 66% of the country's health care budget. [2] In 2015, the estimated medical costs attributable to fatal and nonfatal falls was approximately $50 billion. [7] Nonfatal falls resulted in Medicare costs of approximately $28.9 billion, Medicaid costs of $8.7 billion, and $12 billion in private insurance claims. [7] Overall medical spending for fatal falls was estimated to be $754 million, [8] excluding the costs associated with rehabilitation and long-term care. In addition to the sheer number of older adults who die or experience a disabling injury from a fall, these staggering costs further support the need to find more effective fall prevention strategies for at-risk older adults.

Physical therapy, or physiotherapy, (PT) is considered an effective means of improving a patient's strength and balance which seem to have a mitigating effect on falls among older adults. PTs also have the expertise to counsel individuals with specific health conditions on how to incorporate PA safely in their daily routine. However, the current medical model of PT consists of a short-term "bolus" of treatment followed by discharge with a home exercise program (HEP) and/or recommendations to participate in some community-based activity program. If these individuals do not continue to exercise, they quickly lose the functional gains made in PT and begin to decline physically within a few months of discharge. [7,9,10] Barriers to exercise adherence include lack of interest, poor health, inclement weather, depression, fear of falling, and low expectations for positive outcomes.[7] These barriers are similar to the ones that prevent older adults from participating in any type of PA [6] and further support the ineffectiveness of the current model. Lack of adherence to the HEP post-discharge and the resulting functional regression typically increases one's risk for balance loss, mobility limitations, and recurrent falls. These complications often require additional bouts of PT treatment or permanent, institutionalized care [11].

As the number of older Americans requiring skilled, supervised exercise continues to grow, it is expected to surpass [13] the number of physical therapists who have the skill to meet their healthcare needs. [14] This combination creates a need for more efficient and effective systems to deliver exercise programs to older adults. Numerous studies have shown that older adults who routinely participate in a group exercise class demonstrate improvements in their balance, strength, endurance, and functional activity. This study differs from previous studies in that it focuses on a population of older adults with known balance impairments who have already completed a formal course of PT and compares the outcomes of two follow-up interventions: (1) a PT-led exercise group (GroupHab) and a self-monitored HEP. The GroupHab wellness approach is an alternative to the current medical model of care in that it emphasizes the PT's role as the facilitator of PA in older adults with the goal of preventing falls and reducing the financial burden associated with traditional health care.

2. Methods

GroupHab Physical Therapy is a privately-owned physical

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therapy practice in South Carolina (USA) that provides a unique model of PT-designed and supervised group exercise classes. The classes provide post-discharge options for maintaining the functional gains made during PT treatment, as well as solutions for individuals wanting to exercise to stay strong and healthy, under the guidance of a licensed PT who has extensive experience working with geriatric clients. A multi-component exercise program consisting of aerobic, strengthening, balance, and flexibility techniques is recommended to prevent falls among frail older adults [15-19]. Thus, the GroupHab class included all four of these exercise components. Different classes target specific functional levels which are recommended by a PT based on a patient's abilities at the time of discharge. Participation in these classes is tailored and individualized with the goal of maximizing each participant's potential. The GroupHab option is encouraged for all individuals who have reached their PT discharge goals but may struggle to maintain their functional gains using a traditional HEP. These individuals are typically older adults who are managing multiple chronic conditions and find it difficult to exercise at home, or in a community-based setting, without the benefit of some skilled supervision.

The GroupHab intervention took place in an outpatient clinic as part of a series of exercise classes that fall under two broad categories: Wellness Classes and Specialty Classes. Wellness Classes include all four major types of exercise (i.e., aerobics, strengthening, balance, and flexibility) while Specialty Classes omit aerobic exercise and focus on the other aspects of wellness (i.e., YogaHab, CoreHab, JointHab). Classes are held Monday through Friday with different classes offered throughout the day. Class sizes vary from 3 to 12 participants each, last 60 minutes, and utilize tempo-appropriate music and simple exercise equipment (e.g., dumbbells, therabands, balance tools). Class instruction is provided by a PT or a physical therapist assistant (PTA) who has been trained and certified to provide the GroupHab Wellness classes. For this study, only those patients who were specifically recommended by the PT attended classes that were selected to meet their functional capabilities.

This study included 56 participants who ranged from 55 to 93 years of age with a mean age of 76 years in both groups. The GroupHab class included 7 men (25%) and 21 women (75%); the HEP group included 9 men (32%) and 19 women (68%). All participants had completed a standard course of physical therapy including balance exercise, gait training, strengthening, and fall risk education. In addition, all had a history of falls, repeated falls, and unsteady gait. Upon discharge from PT, each person was given the choice of attending a GroupHab exercise class in the same clinic or an HEP to be performed at home or in conjunction with a community-based exercise class. Thus, this study represents a quasi-experimental design because participants were not randomly assigned to their intervention groups. The study was approved by the Human Subjects Committee at Anderson University, Anderson, SC.

The HEP included standing exercises, sit-to-stand strengthening, and static standing balance maneuvers to be performed near a supportive surface such as the kitchen counter or sturdy chair. These individuals were instructed to complete this program daily, striving for at least 3x/week. Supplemental community programs available in the area included: Matter of Balance, Silver Sneakers, free exercise at the local senior center, senior exercise classes led by group exercise instructors at the senior center, YMCA water exercise classes, Life Center hospital program ("Exercise is medicine"), and meeting with a nurse and/or personal trainer. Those who chose to participate in the GroupHab class received a recommendation from their discharging PT for a specific exercise class based on their current functional level. Participants were encouraged to attend at least three classes a week and other specialty classes as desired. Actual attendance varied from one to five times a week. Participants were encouraged to continue the classes to maintain their level of health and wellness indefinitely; however, for the purpose of this study, participants had to attend classes for at least three months post-discharge. Although the cost of classes was $100/month, GroupHab sponsorship was offered to individuals who felt that this cost was a barrier to attending.

To measure the effectiveness of each program, both groups were given a multi-item survey to fill out at time of discharge from PT and again three months later. The survey packet included data related to the number of post-discharge falls, activity levels, confidence in balance ability, and quality of life within that three-month time period. The three-month, post-discharge time frame was based on recommendations from a previous study which investigated adherence of older adults with a home exercise program [11].

The following dependent variables were used to assess program outcomes:

(1) Incidence of Falls - Participants were asked if they had experienced a fall in the three months since discharge and to indicate whether medical attention had been required as a result of the fall.

(2) Exercise Adherence and Time - Participants reported the frequency, average daily duration of exercise (in minutes), and type of exercise performed at the end of the three-month exercise period. If they had not been active,

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they were asked to describe the barriers they encountered.

(3) Balance Confidence - Participants completed the Activities-specific Balance Confidence (ABC) Scale at the start of the intervention period and three months later. This scale is a 16-item self-report measure of balance confidence in performing various activities without losing balance or experiencing a sense of unsteadiness. Items are rated on a scale from 0 - 100 with a score of zero representing no confidence and a score of 100 representing complete confidence in task completion. The ABC Scale has been shown to have good test-retest reliability and internal consistency among "community-dwelling" older adults [20] with no significant difference between men and women [20] and no correlation between age and ABC scores [20].

(4) Quality of Life - Participants completed the 20-Item Short Form Health Survey (SF-20) at the end of the intervention period. Item categories in this survey include physical functioning, role functioning, social functioning, mental health, and pain. The SF-20 has good validity and test-retest reliability among older adults living at home [21,22].

Independent t-tests were used to compare the number of falls, exercise frequency, and exercise duration between exercise groups. A repeated measures, analysis of variance (RM-ANOVA) compared changes in ABC scores both within and between groups, and a multivariate analysis of variance (MANOVA) analyzed group differences in multiple quality of life ratings (from the SF-20). All data were analyzed at the 0.05 alpha level using SPSS 24 statistical software.

3. Results

The results of the independent t-tests demonstrated a significantly greater reduction in subsequent falls among GroupHab participants compared to those who performed the self-administered HEP (t=2.811, p=0.009). One GroupHab participant experienced a single fall while eight HEP participants experienced a total of 23 falls (see Figure 1). The resulting odds ratio for subsequent falls was 2.2 among HEP participants and 0.2 among GroupHab participants. This indicates a two-fold increase in fall risk among HEP participants and a reduced fall risk (approximately 80%) among GroupHab participants. Exercise adherence was also greater for those who participated in the GroupHab classes. They recorded greater exercise frequency (t= -3.253, p=0.002) and more exercise minutes (t= -7.188, p<0.001) compared to HEP participants. The intervention groups also differed significantly on changes in their balance confidence (see Figure 2). GroupHab participants' ABC scores improved by an average of 5%, while mean scores of HEP participants' scores decreased by 6% (F=16.877, p<0.001, power=0.981). Although our multivariate analysis of the SF-20 scores revealed no significant difference overall (F=0.768, p=0.73), the univariate analyses showed significantly greater improvements among GroupHab participants in four components of the SF-20 including "bending, lifting, stooping" (F=7.862, p=0.007, power=0.786), "walking one block" (F=4.7-6, p=0.035, power=0.567), "bodily pain" (F=6.099, p=0.017, power=0.679) and "feeling bad lately" (F=4.589, p=0.037, power=0.557).

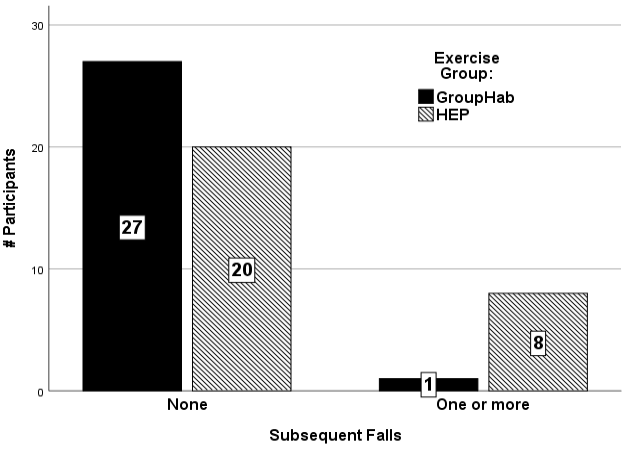

Figure 1. Comparison of recurrent falls among participants in the wellness class (GroupHab) vs. home exercise program (HEP)

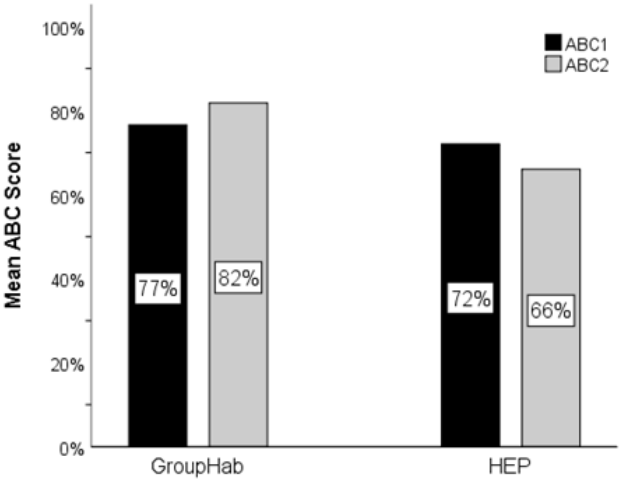

Figure 2. Comparison of changes in ABC scores (over 3 months) between groups

4. Discussion

Despite ample evidence to support the benefits of community-based exercise classes for older adults [2], more frail,

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at-risk individuals avoid participation due to fear of not being able to keep up, fear of falling, and lack of support from healthcare providers.[17] However, our results indicate that a wellness approach to group exercise led by a PT with expertise in working with a geriatric population, can successfully overcome these barriers and have a mitigating effect on subsequent fall risk. In addition, this alternative model of physical therapy, including the PT-designed and supervised exercise classes used in this study, appears to provide older adults with a greater opportunity to continue progressing after their discharge from rehab, as opposed to regressing. Past recommendations that have resulted from international initiatives such as the *Exercise and Physical Activity and Aging Conference* (ExPAAC) have emphasized the need to tailor such exercise programs to each person's functional level and use a variety of progressive exercise approaches to keep seniors actively engaged [23]. These strategies were incorporated successfully into the GroupHab class which yielded better outcomes than a traditional HEP including fewer reported falls, greater exercise times and frequency, improved balance confidence, and improvements in several quality of life ratings. Not only was the PT able to design the classes to fit the needs and capabilities of each participant, but she was able to closely monitor participants and progress them as needed. Previous research has demonstrated that exercise programs for older adults are often "under-dosed" due to fear of overstressing weak muscles, painful joints, or an inefficient cardiopulmonary system; thus, they select an intensity that meets the needs of participants who are functioning at the lowest activity level [15,16]. As with many HEP programs that begin at a relatively low level, these programs are frequently abandoned by participants who become bored and perceive that the program is not making a difference in their functional mobility. Because PTs have first-hand knowledge of their clients' medical history and functional capabilities, they are better able to safely challenge and motivate older adults in a progressive manner. Furthermore, the social support that occurs in group exercise classes may contribute to increased exercise adherence, self-efficacy, and improvements in quality of life [8,17,24]. For those individuals who are isolated at home due to the coronavirus pandemic or other reasons, this type of program can easily be adapted to a virtual format.

5. Conclusion

By using an alternative delivery of physical therapy for aging adults that includes a post-discharge continuum of care which has a wellness focus, we were able to successfully improve balance confidence, exercise time and adherence, and reduce the number of recurrent falls. In addition to improved physical mobility outcomes, a cost-effective, PT-led intervention in a group setting may provide better social support that can improve the older adult's perceptions of his or her quality of life [17].

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ARTICLE

Age-Friendly Communities: Creating a Conducive Environment for the Elderly in India

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ABSTRACT

India is one of the nations in the world where the population is undergoing anomalous demographic changes. The increase in longevity and decrease fertility lead to the boom of older people aged 60 and above both in relative and absolute terms. Due to the rise in number, it creates pressure not only on the family but the responsibility shifts to the government also. This issue becomes a significant social problem not only in India but across the globe. The government had taken action by creating policies and programs to provide services to them. Still, the majority of the elderly population is lacking behind in these areas like health facilities, infrastructure, living arrangements suffering from isolation, loneliness, abuse, crime. Nowadays, smart city initiatives are taken by the government across the country but still in process. To involve and facilitate more cities for "age-friendly", the World Health Organization develop the Global Age-Friendly Cities Guide and a manual "Checklist of Essential Features of Age-Friendly Cities". Cooperating with 35 urban communities from developed and developing nations, the WHO oversees eight highlights for age-accommodating urban areas in the space of urban life. This paper had an objective to study and understand exiting literature on age-friendly communities in developed and developing countries and draw attention to the need to create age-friendly cities in India. The realization of the needs and demands of older people, the Indian government should give attention to promote and implement more age-friendly communities all over the country. This initiative till now taken in 3 states, i.e., Delhi, Udaipur, and Kolkata-which involved in age-friendly community initiatives collaborated with WHO. In this era of a rapid aging sphere, the communities have to enhance in such a manner where the older population can meet their needs quickly without any conflicts and problem. To conclude, the government and policymaker should emphasize the policies into practices to build age-friendly communities across the country and make better living conditions for "all-ages". For timely action and productive recommendation, it is an urgent need on the part of the government, policymakers, researchers, social workers to develop and enhance the community's facilities, which can gain confidence and wellbeing of the elderly in India.

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1. Introduction

"*An age-friendly world enables people of all ages to participate in community activities actively and treats everyone with respect, regardless of their age*" [1].

India was consistently subject to encounter unusual demographic conversion from the last three decades. Due to an increase in the length of life span and decline fecundity results in the expansion of the elder population age 60 and above [2]. India became the second largest in the world, comprising 1.31 billion population, i.e., around 17% of the total populace [3]. Stipulated by the United Nations Population Division, which structures gauges that India will conquer China by 2028. The surplus population in India indicates a higher percentage of the growing elderly population significantly. At present, the process of increase in the size of the elderly is threefold as that of the whole population [4]. This outcome would create a problem at present and in the future in terms of health, socio-economic, and other facilities. In response to these challenges, the government must adapt and recognized the transformation and changes that occurred and provided some suitable alternatives in such a diverse country.

The reason for study age-friendly communities in India because this concept adopted in developed nations, and somehow, they achieved their targets and fulfilled the needs and demands of older people. In India, there is a lack of researches regarding this concept. It may be due to lack of awareness, and less initiative was taken on the part of older people to enhance their life in a better way. WHO gives an agenda incorporates outside spaces and structures, transportation, lodging, social interest, regard, and social consideration, metro cooperation and business, correspondence and data and network backing and wellbeing administrations through which it covers general advancement and improvement in the states of older individuals [5].

2. Defining the Elderly

The United Nations has accepted the age of 60 and above to consider the older or elder person [6]. In India, "Senior Citizens" defined in the Maintenance and Welfare of Parents and Senior Citizens Act, 2007, a person who reached the age 60 and above. In this paper term "senior citizen" or "elderly" or "aged" consider for the same age group, i.e., age 60 and above.

As most of the studies showing interest in the future older generation belonging to age group 50-59 to recognize their needs and demands to formulate sound policies and programs for them in the future [7].

3. WHO Global Network of Age-friendly Cities and Communities

The idea of age-friendly cities and communities developed from the global debate conference on "active aging" in the year of older people in 1992. "Active Aging" itself emphasizes maintenance and taking care of the needs and requirements of the elderly population. It is not static to physical activeness but to develop a suitable environment for them as they get the chance to achieve mutual benefits as well as established active social functioning. The cities should be age-friendly but not particularly to a specific group but for all ages as different ages have different functional capacities. With the increasing number of the elderly population approaching cities creates many issues as a city have a particular environment which has to speculate. Taking concern of this subject matter World Health Organization originates this idea during XVIII IAGG World Congress of Gerontology and Geriatrics in Rio de Janeiro, Brazil on June 2005 [8-10].

In 2006, the WHO propelled the age-accommodating urban community activity. Taking note of that "more seasoned individuals are definitive specialists all alone lives", the WHO and its accomplices held 158 center gatherings in 33 urban communities over the globe. An aggregate of 1,485 more established grown-ups took an interest in talks intended to give a far-reaching appraisal of their urban communities' age-neighborliness. Eight subjects are as per the following: open-air spaces and structures, transportation, lodging, regard and social consideration, social interest, urban cooperation and work, correspondence and data, and network backing and wellbeing. Results exhibited as a complete rundown of 88 highlights that speak to a "general standard for an age-accommodating city". The WHO set up a Global Network that remembers urban areas for 22 nations running from Andorra to the United States [11]. The WHO Global Network of Age-accommodating Cities and Communities was built up in 2010 to cultivate the trading of understanding and collective learning among urban areas and networks around the world. The urban areas need to do a general duty to making comprehensive and available urban situations that advantage their maturing populaces [12]. An age-accommodating city underscores enablement as opposed to disablement; it is well disposed for all ages and not merely "senior cordial" [8].

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Domain	Essential features
Housing	Adequate, reasonable lodging is accessible in territories that are protected and near administrations and the remainder of the network; Inside spaces and level surfaces permit opportunity of development in all rooms and paths; Adequate and reasonable lodging for slight and disabled, more seasoned individuals, with proper administrations, is given locally.
Transportation	All city territories and administrations are available by open vehicle, with significant associations and well-stamped courses; Specific transportation is accessible for impaired individuals; Transport stops and stations are strategically placed, available, protected, perfect, sufficiently bright and well-set apart, with satisfactory seating and safe house; Streets are well-kept up, with secured channels and great lighting; Need stopping and drop-off spots for individuals with uncommon needs are accessible and regarded;
Urban spaces and built environment	Open territories are perfect and lovely; Asphalts are well-kept up, free of blocks and saved for people on foot; The person on foot intersections are adequate in number and safe for individuals with various levels and kinds of handicap, with nonslip markings, visual and sound prompts and satisfactory intersection times; Open-air security advanced by great road lighting, police watches, and network instruction; Outstanding customer bolster blueprints are given, for instance, separate lines or organization counters for progressively prepared people; Structures are well-set apart outside and inside, with satisfactory seating and toilets, accessible lifts, slants, railings and stairs, and nonslip floors
Social participation, civic	A wide assortment of exercises offered to speak to a different population of elderly; Occasions held now and again helpful for aged people; Social occasions including elderly held in different neighborhood network spots; There is reliable effort to incorporate individuals in danger of social detachment;
Participation and employment	The characteristics of more seasoned workers are very much advanced; A scope of adaptable and fittingly paid open doors for the elderly to work is bolstered; Work environments are adjusted to address the issues of incapacitated individuals; Essential leadership bodies out in the open, private and intentional parts empower and encourage enrollment of more established individuals;
Respect and social inclusion	More seasoned individuals are consistently counseled by general society, willful and business benefits on the best way to serve them better; Administration staff are considerate and supportive; Network-wide settings, exercises, and occasions pull in all ages by pleasing age-explicit needs and inclinations; Progressively settled people are seen by the system for their past similarly as their current responsibilities.
Community support and health services	Home consideration administrations incorporate wellbeing and individual consideration and housekeeping; Wellbeing and social administrations are strategically placed and available by all methods for transport; Clear and accessible data given about wellbeing and social administrations for the elderly; Monetary hindrances hindering access to wellbeing and network bolster administrations are limited;
Communication and information	The correspondence structure lands at arranging inhabitants; Standard data with communication are essential to the elderly are advertised; Printed data has enormous lettering, and the primary thoughts are appeared by clear headings and strong face type; Electronic hardware, for example, cell phones, radios, TVs, and bank and ticket machines, has enormous catches and huge lettering;

Source: *World Health Organization, 2007.*

WHO states that being physically and socially determined, the cities must evolve in such a manner that the older generation lives with peace and dignity throughout their life where they have given equal chances to participate in social and civic engagements and had the power of decision making and full involvement. The authority, whether state or local, should ensure their complete protection and security so that they have full confidence within them and fulfilled with being a member of the community [13].

4. Initiatives of Elder-friendly Cities in the Developed World

The work was conducted in New York City in 2007 in four significant domains, i.e., network and municipal investment, lodging, open spaces and transportation, and wellbeing and social administrations [9,14]. Likewise, the age-friendly initiatives were taken in U.K city Manchester in 2010, where issues like public health along with challenges faced by older people were in priority [15,16].

The Age-Friendly activities created by WHO demonstrates the top-down approach wherein arrangement producers and gerontologist lead the change endeavors. The base-up approach centers around the improvement of administration forms that include the elderly in arranging and leadership on the network give that influence them. The base up exertion is the Calgary Elder Friendly Communities venture, which empowered Canadian seniors to characterize and lead network advancement activities in

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their neighborhoods [17].

The study focuses on Shanghai City to promote the policies & regulations for older people to increases public financial input [8,18].

Municipal Public Health and Wellbeing Plan (MPHWP) expects to improve the prosperity and development of the Cardinia Shire social order where they work, adjust, live, and play. The MPHWP centers around highlights of our condition that impact our wellbeing results, for example, access to open vehicles, lodging, land, recreational space and nourishment, and having a safe urban condition with satisfactory streets, pathways, and road lights. Common ecological factors, including environmental change and air and water quality, can affect cultivating and nourishment generation and, thus, our wellbeing. Giving a protected and liveable condition by tending to these key territories can empower individuals to be physically and sincerely more beneficial. The Age-Friendly Strategy is lined up with the MPHWP to help in making a superior spot to live [19] .

It is fundamental to have incorporated physical and social conditions alongside participation among policymakers and the older in building an age-accommodating atmosphere [17]; lack of interconnection among these affects the health and wellbeing [20]. Social activities and communication decrease mental sickness [21]; social connectedness, meaningful interaction, structure needs, and lack of barriers were crucial elements to build an age-friendly community [22]. The physical environment has to improve before meeting social needs as it hinders the path of social interaction for aged [23].

Urban communities over the world have begun variable age-friendly practices, for example, the inception of a network associate program in Ottawa city (for the welfare of the powerless elderly), age-friendly business activity to empower organizations to be all the more age-friendly and draw in senior clients in four urban areas of Spain, constructing an age-friendly Portland in the United States of America, and so on [1]. Buffel T.,2018 has led co-examining and co-creation exercises as a significant aspect of the Manchester Age-Friendly system (MAS). Vital components for achievement of MAS is the activation of on-screen characters to share their experiences and gain from one another about the necessities and prerequisites of their networks. The idea of an "Age-Friendly Business" has empowered organizations in the system to make modifications to encourage straightforward entry or administration by occupants. Such modifications or changes include: helped gadgets to open entryways, expanding the text dimension on menus, and changing the stature and access to latrine allocators [24,25].

Yoshihiko Kadoya, 2013 examined the social correspondence between the old and the system in Akita city, where their region a high number of senior individuals in Japan. He found that living courses of action and versatility fundamentally influence social collaborations. The individuals who can drive took an interest in more in-network administrations. He reasoned that a network ought not to disregard social consideration as a space for an age-accommodating condition [26].

Ann Bowling, 2008 investigated dynamic maturing by looking over 337 older British people utilizing surveys. The review results uncovered that most of the older depicted dynamic maturing as having notable psycho-physical health while at the same time keeping up a free association with society [27].

The estimation model of dynamic maturing was proposed by Constança Paúl et al., 2012 [28]. They presented a model that encourages the older to conform to their handicap, advance social investment, and be included effectively in a reliable way of life, which would improve their satisfaction. Somi An et al., 2013 reviewed old Koreans. They found that free exercise regions have a noteworthy association with the old to be physically dynamic, which advances sound and dynamic maturing [29].

5. Status of the Elderly in India

A massive change in the statistic situation in the 21st century in India is the quick development of the older populace with extensive results in monetary and cultural terms. Registration 2011 uncovers that 100 million more established individuals matured 60 or more contain 8 percent of the all-out populace, and it would be assessed 20% by 2050. From the last few decades, the statistic showed that young India would be soon older. India, in the upcoming years, would affect society as well as the whole country in many ways. Estimated between 2000 to 2050, the older population could be 60% while the aged population 60 and above will grow by 360 percent [4].

The older people accompany with many problems like health issues, security, financial crisis, social isolation, abuse, loss of self-esteem [30,31]. Due to urbanization and globalization, the transition of the joint family to the nuclear family system, living arrangements were keen to be noticeable. Many studies reveal that housing is the most crucial element in the life of older people [7,32,33].

Indeed, even NFHS information waves from 1992-93 and 2005-06; and Sathyanarayana et al. (2013) show the adjustment in the structure of living game plans in

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India. They locate that around three-fourths of older co-dwell either with their life partner and kids and grandkids. Strikingly, in short, between review period, the extent of older folks living alone or just with their companion (along these lines autonomously of their youngsters) expanded from nine to nineteen percent [43]. In Orissa, study indicated that the extent of the elderly who lived with their kids had diminished from 31 percent to 26 percent in urban areas, and the portion of the elderly who lived with different relations and future-relations had expanded from 3 percent to 5 percent in urban areas. The situation indicates the weakening of the extended family system [7].

Report of National Crime Records Bureau, "a total of 8,973 cases registered as crimes against senior citizens from January 2014 to October 2014". The partial population of the elderly consistently experiencing ill-treatment reported along with discourtesy and ignorance [34].

The residential environment must cater to the fundamental needs of the old population and furnish them with basic aid and assistance for their prosperity [33]. Besides providing medical and financial services to the elderly, the living environment of the elderly should be taken into consideration. The problem is a much more serious concern in low-income group families, where the loss of budgetary autonomy makes the older a weight for their families. Due to the absence of children, relatives & kinfolks to deal with their elders, the duty has shifted to government which become serious social issue.

6. India towards Building an Age-friendly Community

"Age-friendly environments (such as in the home, community) foster healthy and active aging by building and maintaining intrinsic capacity across the life course and enabling greater functional ability in someone with a given level of capacity"[1].

The concept behind the Age-Friendly Community is to involve the elder as an active actor to engage themselves in community settings and active participation to improve their lifestyle and environment, which imposes healthy & active aging. With the help of the Active Aging framework, it forms the basis of the Age-Friendly Community. Major components will be a strategy, facilities, surroundings, and situation supports and enable older people to recognize their potentiality and capacities [35].

From 46 nations, India is one of them to authoritatively team up with WHO-Global Network of Age-Friendly Cities and Communities. In which three states involve in Age-Friendly initiatives, i.e., Delhi, Udaipur, and Kolkata. The study has the basic requirements that cities should possess to be available and liveable for the elderly have suggested. The report is a guide for cities to enable "active aging". It look after the features like- Outdoor Spaces and Buildings, Transportation, Housing, Respect and Inclusion, Social Participation, Communication and Information, Civic Participation and Employment, Community Support, and Health Services.

Following initiatives in these states are as follows:

S.no.	State	Programme Initiated in City & Problems	Target Group	Results/Outcomes
1.	Delhi	The programme initiated in South Delhi in Sangam Vihar were no government services like water, electricity, and sewage facilities available in that area. Even they have little contact with local authorities, and mostly elders were concerns about their safety. A program is started to encourage contact between more established grown-ups and network road watch cops, which was actualized in 6 wards of Sangam Vihar, covering around 1800 more seasoned grown-ups. With the help of the nearby political authority and two neighborhood police headquarters, more seasoned grown-ups met their neighborhood ward cops. They were given cards in which they have a photo with their name and contact quantities of all road watch cops. To empower the utilization of cards, the more established grown-ups rehearsed by calling their nearby cops, and the police headquarters made a register of the taking an interest more seasoned grown-ups with the goal that they would be perceived in the event that they brought in once more. Wellness Health and You began intercessions to show the age-pleasing urban zones/systems movement and has now got the South Delhi Municipal Corporation as a person from the GNWAFC. Another mediation grasped with the assistance of W.H.O-S.E.A.R.O was the development in the Sangam Vihar to get together the body electorate zone. This area is the most huge ghetto in North India. They had the option to present the issue of age-accommodating network and had the option to address the trio of wellbeing security-social cooperation among the seniors of the territory. Through this mediation, they are attempting endeavors to invigorate the country and social associations to take an interest in further exercises.	Older people	Through this program, the result is positive which shows that in that area around 50 percent older people are starting to holding contact cards Likewise, the cops distinguished more established grown-ups living alone and completed intermittent visits to their homes. Still, personal security for older people became a huge problem.

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S.no.	State	Programme Initiated in City & Problems	Target Group	Results/Outcomes
2.	Udaipur	Observed in the "Age-friendly cities report Udaipur" which examine the middle-income group differ from that of the low-income group. While the middle-income group was concerned with the economic and infrastructural developments, and the low-income group was more concerned about their "marginalization due to loss of income and lack of medical assistance" [36].	Older people	The investigation is dependent on the point of view of senior residents. However, the solutions that have proposed are comprehensive as the proposed measures have not been quantified in terms of their numbers, distances, etc. This study shows selections of individuals fluctuate with their pay structure and social milieu. The study thus establishes the need to develop residential neighborhoods with amenities that contribute to the fulfillment and prosperity of the senior citizens in India.
3.	Kolkata	The study conducted in different cities in the state of West Bengal in India. This examination will recognize the differed needs of the different levels of mature age alongside those having a place with future older and propose potential answers to improving their QOL in private neighborhoods. The project is "self-management and community initiative for joint pains and hypertension in older women". The effort was initiated at New Barrackpore, a suburban area of Kolkata in the state of West Bengal. They started the workshop and created awareness about joint pain and hypertension. They advertised by local TV operators with a campaign stating "Awareness and Assessment of Joint Pains and Hypertension in Older Women". Exercise and diet mediations disclosed to the chose subjects. Asset material dispersed to each chosen member.	Older women equal to or more than 50 years of age. Limitations: Women who were bedridden and requiring long term care, diagnosed with accelerated hypertension, severe cardiac neurological disorders excluded from the study.	In this way this task led in Kolkata, where they featured the urban pieces of the province of West Bengal, shows a higher pattern, with 9.3% of the populace as more established men and 9.6% as more seasoned ladies. They make mindfulness and show self-administration of joint torments and hypertension through activities and diet adjustments to more seasoned ladies. They associated more established ladies to network and companion bunches for bunch treatment, which has comparable issues. They attempt to make a future model for feasible and financially savvy network wellbeing administrations and advance age-accommodating networks.

Source: *WHO, Age-Friendly World, 2012; Who, Age-Friendly World, n.d.; HelpAge Research Reports.*

7. Other Initiatives

A similar observation has been found in another study on "Built Environment for the Elderly" conducted by A.K. Jain, which proposes different measures and rules that are required to be joined into the constructed condition to be age-friendly city. HelpAge India's report "Enabling Environment" additionally proposes framework/recommendation for the structural design of buildings for the exceptional needs of the seniors. This report only looks into the architectural details of the building with a few broad outlines related to the site. Whether the latter two studies based on the perspective of the elderly is unclear. A survey of the researches so far carried out in India indicates that the relationship of the neighbourhood with quality of life (QoL) of the elderly remains a hugely unexplored area.

Undertaking enormous scale network outreach projects and workshops to advise individuals about the proposed plans, recognized from their reactions, to take into account the requirements of the senior residents and look for their co-activity in the execution of the equivalent and conducting experimental studies at different neighborhoods to test the adequacy of the proposed solutions in improving the quality of life of senior citizens. Manuals for the creation of community built environment facilities/features that will enhance the Quality of Life of citizens with the focus on the different age groups of the elderly population based on the city's capacity to deliver the solutions. Also study shall identify how to priorities for Quality of Life indicators may vary among the elderly and the future elderly. This study can be useful for determining the required neighborhood features for the next generation of elderly and also bring out an suitable solution between the requirements of the elderly and the working-age population. Study also indicate how the priorities for Quality of Life indicators vary with different socio-economic, demographic, and neighborhood characteristics and also identifying the required neighborhood features for respective target population groups. Guidelines for the allocation of social support services to cater to the needs of residents with the focus on the different age groups of the elderly population (the "elderly" and "the aged") [7].

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8. Prerequisite for Creating a Conducive Environment for the Elders

Developing countries like India sharing the older populace urban territories will increase multiple times from 56 million of every 1998 to 908 million by 2050 [36]. After seeing such a vast increased in the number of elderly, it is essential to create a conducive environment by providing services and structure to support their residents' wellbeing and productivity and improve their quality of life [7]. It observed that the elderly are physically active and mentally alert, while different aged need different types of support. [37] Elderly peoples require strong and empowering living situations to make up for physical and social changes inside them.

The government has to make the existing system and structure more "age-friendly". The approach should be a bottom-up approach as for implementing any plan & strategy on the ground; the elder must have consent over it. The health sector can induce a crucial role in making an "age-friendly" community. Health strategy is useful in both upstream & downstream efforts, and this can be only possible if professionals of different sectors like policymaker, gerontologists, medical social worker, and researchers involved and communicate each other strength to ensure and make such policy, programs, and a structure which affect the older population positively.

Active aging should promote as this can be a life savior activity for older adults. Concentration on the needs of the older population, it is necessary to look after the resident other stages of life-course. Last but not the least other states should encourage to step up in building an age-friendly community and city, especially those where the elderly population is large in number. The researcher should explore the best and suitable ways of strategies for age-friendly communities for "all-ages".

9. Conclusion

The system in India ought to be old and disabled welcoming. As India continues modernizing its establishment, arranging spaces for developing people will incorporate structure structures, modifying transportation, and executing organizations that address the issues of progressively settled adults and that address the principles of inclusivity, transparency, and accessibility. This effort has started with Kolkata, Udaipur, and New Delhi ending up being people from the WHO Age-Friendly World Global Network, a framework concentrated on sharing best practices in urban sound developing and propelling age-obliging system fragments, for instance, open structures and open travel, customer care that is altruistic to progressively prepared adults, and fitting open spots for walking and resting [8]. With both urban and provincial conditions that frequently present enormous portability difficulties to more seasoned grown-ups and people with incapacities, progressively Indian states and urban communities need to understand the significance of a constructed domain available to the elderly population.

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ARTICLE

Aging Experience and the Results of the West for Asia-A Sociological Perspective

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ABSTRACT

The present paper analyzes different demographic variables to reach the result of how population become aged in different parts of Asia. Policies and planning of population during the past decades have contributed to more life expectancy, leading to the aging of population in countries like Japan, China, South Korea, Singapore, Taiwan and to some extent Iran. Population in some countries aging without needs gradually emerging, being met. People usually at the age of seventy and over lose their normal strengths and potentialities. Many of their capabilities are lost. They gradually become dependent on other younger age groups. Western countries usually have made better policies and plans earlier, and because of that, their aging people have better immunity as far as their health, social and economic conditions are concerned. Many aging people in Asian countries are concerned about their needs during the age of 70 and over. Decline in birth rate is the most important factor positively affecting the aging of population after a few decades has passed. The same happened to Japan, China, South Korea etc. Many Western countries started narrowing their birth rates in the nineteenth century, whereas Asian countries started that since around 1950. Earlier, women used to give birth to 7-8 children, in which half or more of them died in infancy, and the rest who survived, had to face malnutrition, shortage of education, child-labor from the age of 7-8, maternal fatality of mothers and many more unfavorable conditions that affected their lives. While the average age of marriage is between 26-29 in the West, it is usually the age of 20 or below within many developing countries.

1. Introduction

Sociology as a comprehensive social discipline aprising and investigating various phenomena, will now analyze the state of childbirth worldwide. For almost all women childbirth is a natural and happy experience through which new life is brought into the world. But, for increasing number of women who live in developing countries such as Niger, India, or Uganda, Childbirth are a risky endeavor. Though humanity has so far continued through childbirth, and a result of which has been continuity of generations among nations regardless of race, creed or religion, childbirth is facing complications because of science, technology, migration and organization around the world. Some countries that more scientifically developed, face less problems, so far as child

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bearing is concerned. One of the risks of pregnancy and childbirth is associated with pregnancy- related deaths of women/ mothers. Repeated and back- to- back pregnancies can deplete the mother's essential nutrients, giving the mother the risk of anemia and other complications including death. The babies of such mothers are at the risk of low birth weight and preterm birth. In the countries where mothers give birth of 7-8 babies, mother remains at very high risk. However, there is a clear connection between high fertility rate and maternal mortality rate. UNICEF indicates that women in countries like Niger, Afghanistan, Sierra Leon, Chad, Angola and many more, are at high risks of pregnancy-related diseases and other complications.

According to UNICEF lives of the newborns as well as the mothers could be saved simply through right medications, improving health measures, educational development for the girls and the like. All such measures strongly save maternal deaths. In case women and girls are provided a low status in the society, their health needs are more often neglected.

2. Method of Research

Methodology used in the present article is of qualitative type. In that, various paradigms have been used to find out facts regarding divorce. Qualitative research usually studies people or areas in their natural settings. In finding facts for the research, the researcher engaged in careful data collection and thoughtful analysis of what was relevant. In the documentary research applied in the present article, printed and written materials were widely regarded. The research was performed as a qualitative library type in which the researcher had to refer to relevant and related sources. In the current research various documents were thoroughly investigated, and the needful inferences were made. The data fed by the investigator in the present article is hopefully reliable. Though literature on childbirth is very limited, yet the author tried to investigate many different resources in order to elicit the necessary information to build up the text.

2.1 Birth Rate

Childbearing comes into being through fertility achievement, and via male-female connection. According to United Nations, "Natural Fertility is the fertility which exists in the absence of deliberate birth control" [21]. According to the same source, controlled fertility is the fertility that involves a deliberate use of birth control [21]. On the other hand, the term birth control is used in a broad of sense to include international abortions, sterilization and complete abstinence from coitus. Contraceptive method is sometimes taken as identical with birth control method. though it is a part of it. However, most persons use contraception and birth control in the same sense. Contraception, as is clear by the term is opposite of conception. Fertility refers to the actual reproductive performance ¯ applied to an individual or a group [21]. Fertility can be measured through birthrate. So, a woman who has given birth to a live child is considered fertile. On the other hand, those who have not produced a single child are considered sterile. The total number of children born by one couple are known as "Family Size". The physiological limits of childbearing capacity and period are known as "Theoretical Maximum Fertility". Similarly, abortions and still birth are classified as reproductive wastage. All those concepts are understood as the trends and causes of childbirth and fertility.

Table 1. Average age of first birth in selected developed nations by age, 2015

US	26.4
Latvia	26.5
Poland	27.0
Slovakia	27.1
Estonia	27.2
Iceland	27.5
Hungary	27.9
Czech Republic	28.2
Canada	28.5
France	28.5
Belgium	28.7
Slovenia	28.7
UK	28.7
Finland	28.8
Norway	28.9
Austria	29.2
Denmark	29.2
Sweden	29.2
Germany	29.5
Portugal	29.5
Ireland	29.5
Netherlands	29.7
Greece	30.2
Luxembourg	30.2
Switzerland	30.6
Japan	30.7
Spain	30.7
Italy	30.8
South Korea	31.4

Note: *All statistics are based on OECD countries available.*

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2.2 Maternal Mortality vs Birth Rate

Maternal mortality is unacceptably high more because of increasing childbirths among the women with the special reference to the developing countries. Majority of such deaths or about 90% occurring in low-infrastructural countries, and most could have been prevented [20]. Similarly, South Asian countries, and Sub-Saharan countries in Africa, approximately involved 254000 or 86% of the world maternal deaths in 2017. Risk of maternal mortality is highest for adolescent girls under the age of 15 years old and the complications in pregnancy and childbirth are higher among girls 10-19 as compared with age groups 20-24 [6].

Such catastrophes leave behind increasing issues for the remaining children in different stages of their lives. Such mother-less children cannot easily access education, proper socialization, and alike. Eventually, they get into child-labor; a situation which will impact next generation as well.

In high income countries one in every 5400 die as a result of maternal death, while one in 45 happens in low income countries. Women die as a result of complications during and following pregnancy and childbirth. However, most of such complications are treatable, if infrastructure is available. In case clinical management is maintained, a large number maternal deaths among the women in developing countries could be prevented [15]. Poverty distance to facilities, lack of information, inadequate and poor quality services, and finally cultural beliefs and practices are known as the main causes of maternal deaths [16].

In countries like Poland, Iceland, Norway and ... there are only three maternal deaths versus every 100,000 births; Leaving behind golden opportunities for children so far as socialization and education are concerned.

2.3 Health Policy vs Childbirth

During the past three decades many organizations have been engaged with progressive and planning toward childbirth in increasing number of countries. In that, private providers have been active in low and middle- income countries in an effort to improve the reproductive behavior in the process of fertility [5,23].

In some countries public and private health facilities both act simultaneously based on the choice of the clients, and quality and cost [7]. But currently the available data do not show the increasing and in-depth interfere of the private sector so far as maternal health across countries is concerned. In some cases, mothers who refer to a facility for delivery care, they may choose the private facilities. Though in many countries the public facilitates is the main and first choice, yet for some reasons, some women may choose the private facilities. Literature on facility choice has found a wide range of determinants. Evidence through Asia has shown that socio- demographic groups most often of higher education contribute to private facilities choice by the women [3,19]. Other relevant factors like ethnicity and caste status are highly associated with the use of private facilities in India. Besides that, quality of income in the family plays a determining part in the choice.

Table 2. Average number of lifetime births in selected developed nations by age, 2015

Iceland	2.3
US	2.2
Norway	2.1
France	2.0
Sweden	2.0
Slovakia	1.9
UK	1.9
Finland	1.9
Hungary	1.9
Estonia	1.9
Czech Republic	1.8
Canada	1.8
Netherlands	1.8
Poland	1.8
Slovenia	1.7
Portugal	1.7
Switzerland	1.6
Austria	1.6
Germany	1.5
Italy	1.5
Spain	1.5
Japan	1.5

Note: *All statistics are based on OECD countries available.*

2.4 Birth Rate in East Asia

Birth rates have widely fallen below 2.1 with the special reference to South Korea where it has impacts on economic growth, cultural stability and other characteristics (Demeny, 2015). Declining fertility rate and contraction of labor force on the one hand, may have negative effects on economic growth and on the other hand, it has increased the wages of the current labor force- Facilitating pensions, education, health care services etc. [9,22]. South Korea has been experiencing a dramatic decline in birthrate since 1916 when six children were born to per woman, and

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now it is known as one of the countries with the lowest birthrate in the world [13]. While the number of kids and the youth declines, and the proportion of aging people increases, such a decline, in work force will ultimately impact the countries economic vitality, with regard to increased costs of health's and social care services [12].

Industrialization is known to be a driving force for the decline in fertility in developing countries where technological and financial help for birth control is provided by international organizations. In addition, the decreasing birthrate is associated with norms, values and attitudes regarding marriage, lifestyle, parenthood, gender role, attitudes, gender quality values etc...[1,2]. Similarly, higher rate unemployment of young adults, nuclear family formation, gender equality issues and the like all helped change in family patterns in South Korea. The phenomenon has been continuing to the recent time.

Population planning in South Korea has widely helped the country to grow up its industries, economy, international trade and overall its GDP per capital as compared with other Asian and developing countries. Currently, right after Japan, South Korea is counted as the most developed country in Asia.

2.5 East Asian Marriage and Family

East Asia is known as symbol of population policy and planning during the past half-century. Family behaviors and patterns widely changed in china, Japan, South Korea and Taiwan. These countries pay much attention to the family lineage and ancestor worship particularly Pronounced in Chinese culture [17]. A great value in Chinese family is that children or grandchildren must respect for the parent or grandparents [18,Whyte, 2004). It happens so with South Korean families and perhaps to a lesser degree with Japanese Families [8].

China declared its one- Child Family in 1979; a plan that highly changed the family values and norms, brought more employment for the women, gave them more economic independence, gave them better health and so on. Single- child family continued in china until 2015, when the family was permitted to have a second child then. Pressure of labor and employment caused the marriage age and childbearing to increasing; the phenomenon that caused total fertility rate (TFR) to decline, and even many families remain childless in their lives. The whole scenario has contributed to the increase of the elderly people in those countries. Aging of population is also penetrating into the other developing countries too.

The social and demographic changes entered the above four countries, will continue within the emerging generations in the years to come. Such milestones will remain and even switch to other generations contributing to further social changes in future. The demographic scenario will lead to shortage of babies which must be compensated by electronic man force.

Table 3. % of women who never gave birth in selected developed nations, 2015

Czech Republic	9%
Hungary	11%
Denmark	12%
Portugal	12%
Slovakia	12%
Norway	13%
Slovenia	14%
US	14%
Sweden	14%
France	14%
Belgium	16%
Netherlands	18%
UK	18%
Ireland	19%
Austria	19%
Switzerland	19%
Finland	20%
Spain	21%
Italy	21%
Germany	23%

Note: *All statistics are based on OECD countries available.*

2.6 State of Childbirth in Africa

Childbirth in Africa is very poor and heartbreaking ˙ most often it causes the death of mother in the family. Pregnancy and childbirth complications are very common in developing countries, but much more wide in African countries. Yet, women are known as source of wealth and health in their communities, and without them family will not continue. In Africa, as found out, an amazing one woman in every 22 women dies in pregnancy- related complications, there as in UK one in every 8000 deliveries leads to a maternal death. Traditions and norms contribute to repeated and continued births within the African women. Shortage of access to quality facilities transportation, and trained midwifes escalate the problem.

Many women in remote areas have to deliver their babies just at home where they are likely to catch diseases or die. But, if there is a mother or grandmother beside her the chance of having a healthy baby and the unlikeliness of maternal death increases. On the other hand lack of transport and having to walk to the delivery center increases

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the chance of maternal death in African society.

Women undervalued and highly vulnerable, they try to have more sons, a motion that increases their total fertility rate (TFR). However, newborn health and survival are much linked to the care the mother receives before and during pregnancy, childbirth and postnatal period. Throughout the continuum of care, the period of highest risk of disability and death, there are threats for both mothers as well the newborns. Labor, in the first few hours after delivery is there. Complications at this time are very likely for both mothers and babies with grave consequences [14]. So, African countries need more investments and infrastructures to improve the situation so far as the maternal mortality and vulnerability are concerned.

Table 4. State of maternal mortality in selected industrial countries, 2015

Sweden	4
Norway	5
Switzerland	5
Austria	6
Germany	6
Canada	7
Netherlands	7
France	8
UK	9
New Zealand	11
US	14

Note: *All statistics are based on OECD countries available.*

2.7 Causes of Low Fertility in Asia

Social modernization has caused increasing social change in many parts of Asia, among which low fertility is an effect. Social modernization as increased schooling, extended average age of marriage, decreased marriage events and those occurred in later ages, get the chance of fewer child bearings. Besides, as marriages happen late, many families cannot reach their son preference that they really wish for. So many of such countries will later face the imbalance of sex ratio. Low fertility though not an issue at the time being, it will be problematic later. So the high most causes of decreasing is the rise in Women education levels and employment rates.

Currently, the four Asia's most prosperous economies - Japan, Singapore, South Korea and Taiwan, now have the lowest birthrates in the world despite the reported statistics, Survey results declare that all the young women in this societies wish to marry and have children. But, actually speaking lack of childbearing in many parts of the world. Results in aging of population and shortage of young man-power.

However, despite maternity leave and children leave from work, assistance with childcare through daycare centers after school programs provision of housing facilities, medical insurance, expenses related to pregnancy and childbirth, women do not accept regular marriage and child baring.

As sociologically observed, fertility in East Asian countries will remain low at least foreseeable future. Economic competition within the societies concern [4], will retain population growth at very low rate for the coming years.

3. Conclusion

Sociology as a multi- Dimensional discipline evaluates childbirth from different angles. This natural event is under social, economic and political decisions of governments. It is also under the quality of poverty and affluence of governments in different countries of the world, Countries with fast growing economies the initiative of lowering the birthrates by any means. Similarly, as lifestyles of the youth is ever changing by education, employment, and other patterns, they marry late in their lives and get fewer children or none at all. Also, as death rate has maximally declines, increasing number of young families do not have the motive to plan for large families. Change of standards like high quality of life, better education, better nutrition, and many more, have motivated young couples towards smaller families. In countries where male, female connections have been liberalized, family formation happens late, and the child is not anymore a value within many families. Birth control being highly used, it has lower TFT or total facility rate among many women. While the average TFR is 4.1 in the least developed countries, it is 1.6 in developed countries. This means that in developed countries 1.6 people replace two who die, and in this way Population in these crimes gradually shrinks, While in African countries the situation is reversed, and in that, population size annually boosts. The Phenomenon that leads poverty and lower quality of life. Increasing childbirth highly affects maternal and infant mortality rate. Many developing countries need to introduce effective policies to plan the population. In this way, they help themselves as well as the world as a whole.

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ARTICLE

Management of Geriatric Low Back Pain with Tai Chi

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ABSTRACT

Introduction: Chronic low back pain (cLBP) among older adults is a complex, biopsychosocial condition that despite research efforts and innovative interventions remains a prevalent, disabling and costly condition. This case highlights the use of tai chi (TC) for persistent geriatric LBP. **Case Presentation:** A 68-year-old Caucasian female with cLBP, neuromuscular imbalances, leg weakness and fall risk was treated with a walking program (aerobic), manual therapy (mobility), lumbar stabilization (strength) and group TC class (neuromuscular function). **Discussion:** Research validates TC for a variety of older adult health conditions, but few studies demonstrated effectiveness for cLBP. This case outlines the use of a simplified Yang-style TC for management of persistent geriatric LBP. **Conclusion:** The addition of group TC to standard treatment for cLBP resulted in improved functional outcomes, decreased pain ratings and improved leg strength, flexibility and balance as compared to standard treatment for cLBP. Following the group TC class the client reported significant self-perception of recovery, and these functional and confidence gains eliminated the need for physiotherapy services for cLBP for three subsequent years. **Level of Evidence:** Therapy, level 4.

1. Background

Low back pain (LBP) is the leading cause of disability worldwide. LBP is increasing as a result of aging and is associated with smoking, obesity, sedentary lifestyles, and low socioeconomic status [1]. Mechanistic models of pathoanatomical spine degeneration as an explanation for geriatric LBP are weakly associated with pain intensity and/or function [2]. Age-related senescence of multiple body system and psychosocial factors better explain persistent LBP and disability found in older adults [1-2].

The biopsychosocial model has advanced the treatment of LBP [1-2]. Clinical practice guidelines endorse non-pharmacological and non-invasive management [3-5]. This paradigm shift directs clinicians to address physical (e.g. pain, strength, balance and mobility); psychological (pain catastrophizing, kinesiophobia, depression, self-efficacy); cognitive (executive function) and social (isolation, quality of life) consequences of LBP in older adults [2,5].

A rapidly aging population demands sustainable self-management of cLBP and its associated health risks. Progressive graded exercise, neuromuscular trunk coordination, strengthening and endurance and patient education and counselling should the first-line of treatment for persistent LBP [1-5]. Functional holistic interventions that improve aerobic capacity, strength, balance and mobility, and foster self-efficacy for self-management may limit

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ongoing or extraneous health care services for older adults with persistent LBP [2].

Tai chi (TC), an ancient (13th century) Chinese mind-body exercise, offers a functional holistic exercise strategy to meet the needs of the older adult with persistent LBP [6]. TC is a non-impact exercise that fosters body awareness, postural control, strength, balance and functional and efficient movement patterns [6-7]. The purpose of this case report is to describe the effects of supplementing standard physical therapy (PT) interventions (e.g. aerobic exercise, manual therapy, lumbar stabilization) with group-based simplified Yang-style TC. The addition of TC to standard PT management led to improved functional outcomes and fostered self-management that eliminated ongoing PT services for a three-year period.

2. Case Presentation

2.1 History

The patient was a 68-year-old Caucasian women (5' 8", 145 pounds, BMI=22.1 kg/m^2) with chief complaint of persistent LBP and lower extremity (LE) weakness. The patient a had 30+ year history of LBP and four spinal surgeries over a three-decade period. Her surgeries included: (1) L4-5 discectomy/laminectomy, (2) L4-5 fusion, (3) repeat L4-5 fusion due to post-operative infection failure, and (4) scar tissue debridement surgery. The patient had several prior trials of PT with only modest outcomes (best prior self-perceived recovery was 80% of normal).

Thirty days prior to start of the final episode of PT care, the patient experienced a sudden loss of balance without a fall. This uncontrolled "jerking" motion created immediate onset of right (R) greater than left (L) sided LBP and self-described R LE 'sciatica.' LBP ranged from 4/10 (best) to 7/10 (worst) with spasm in R quadratus lumborum and R gluteal musculature. There was variable pain (3-5/10) in the distal right L5 and S1 sensory distributions. The leg pain was consistently present with the LBP and was mildly increased with coughing/sneezing and Valsalva maneuver. She denied signs and symptoms of cauda equine syndrome. Sleep was mildly disturbed (1-2 hours/night). Aggravating factors included all transitional movements (e.g. bed mobility, transfers, in/out of car), standing, walking, lifting, carrying and squatting. Alleviating factors included slow and guarded movements, lying supine with hips/knees flexed and feet flat on table (hook-lying) and self-selected anti-inflammatory strategies (e.g., ice, acetaminophen and relative rest).

2.2 Physical Examination

Physical examination demonstrated body structure and function impairments consistent with cLBP including interfering pain, postural abnormalities (L lateral shift), muscle imbalance and weakness, reduced neural dynamics and lower extremity flexibility. (Refer to secondary outcomes discussion for all pre- and post-treatment body structure and function impairments measures). Functional limitations included insufficient hip and ankle balance strategies (i.e. poor balance with fall risk); limited ability to stand (< 30 minutes), impaired walking (< 1-mile), difficulty on stairs (less than one flight) and uneven ground (walk very carefully); and inability to freely perform activities of daily living and work.

2.3 Past Medical History

Reported medical diagnoses and associated medications were spinal osteoarthritis (acetaminophen), hypertension (Furosemide), hyperlipidemia (Lipitor), irritable bowel syndrome (MiraLax) with benign colon polyps, hepatitis (recovered) and newly diagnosed osteoporosis (Fosamax, Zoledronic acid (Reclast®). Nonprescription items included baby aspirin (81 mg), calcium supplements, and multivitamin. Other surgeries included colon polyp surgery (x2), cholecystectomy, thyroidectomy (benign tumor), and vaginal hysterectomy.

2.4 Social History and Goals

The patient was married, worked part-time (10-12 hours per week) as a realtor and was active in her community. The patient's goals were to reduce LBP and leg symptoms and return to all prior levels of function (personal/work/social). There was a strong desire to walk 2+ miles per day for cardiovascular health reasons.

2.5 Physical Therapy Diagnosis/Prognosis

The patient had signs and symptoms consistent with persistent LBP with referred leg pain and weakness; global mobility (bed mobility/transfers/gait), local tissue (joint/muscle/neural) mobility deficits and movement coordination impairments ('core' musculature). There were no red flags (biomedical signs of serious pathology), but yellow flags (psychological and behavioral factors) influenced PT management [3-4]. There was a past history of over-reliance on passive LBP interventions (e.g. hot pack, ultrasound, massage and medication) and tendency to slowly deviate from PT home exercise program recommendations. The patient had four previous episodes of PT (annually over a 4-year period). Each time the patient declined participation in balance retraining. Her newly diagnosed osteoporosis and a fear of falling/injury led to a willingness to participate in group TC to address her long-standing

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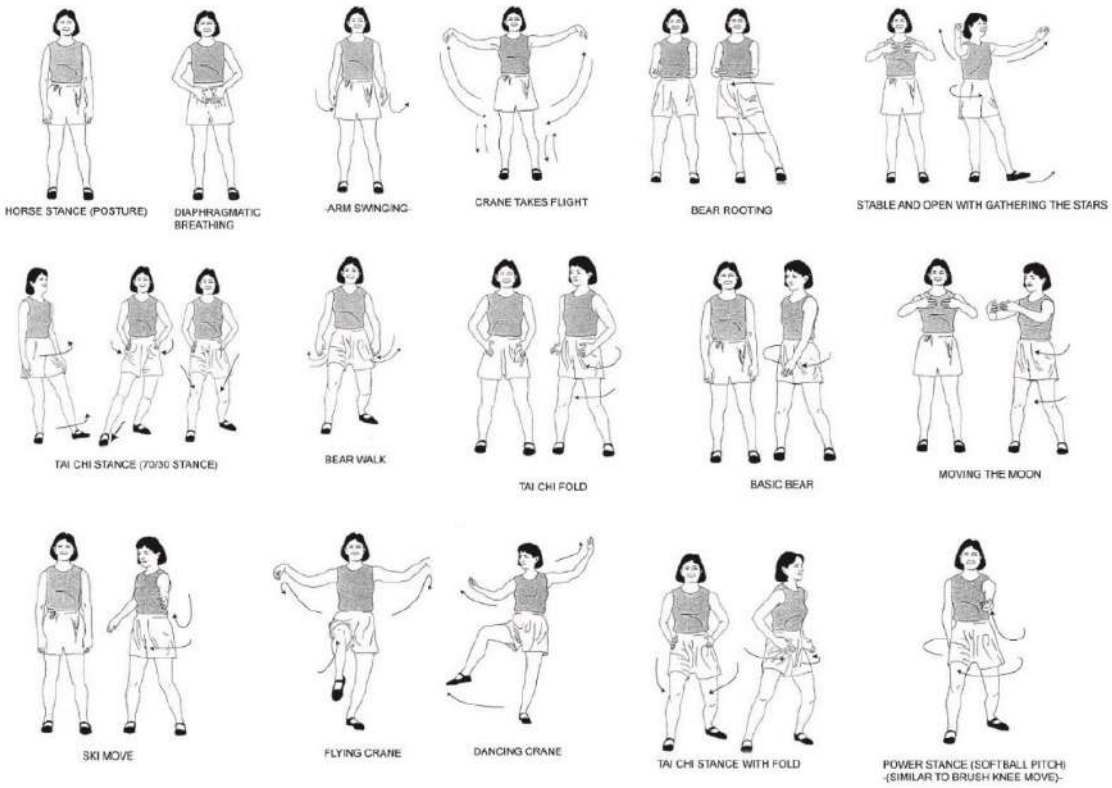

Figure 1. Tai Chi Fundamentals® Basic Moves [7]

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balance and mobility dysfunction.

2.6 Interventions

The patient received fourteen (n=14) visits of PT over an 8-week period via four individualized sessions and ten group TC classes. Standard in-clinic PT interventions included thermal ultrasound[†], manual therapy, neural mobilization, muscle stretching and lumbar stabilization exercises. [NOTE: [†] While there is limited evidence for ultrasound for persistent LBP, patient value for this modality led to in-clinic treatment to promote patient buy-in for physiotherapy.] Manual therapy included joint-specific interventions of manual distraction at L5-S1, side-lying R facet lumbar gapping in flexion and sustained long-axis R hip distraction; soft tissue mobilization of the thoraco-lumbar fascia and gluteals; neural mobilization of the sciatic system and hold-relax stretching of involved LE musculature (one- and two-joint hip flexors, hamstrings, and calf musculature). Training in mindfulness, diaphragmatic breathing and guidelines for TC practice, occurred during group TC classes. PT provided education on osteoporosis risk factors, fall prevention and home safety information.

Early PT visits (#1-3) served to reduce the patient's L lateral shift posture (McKenzie R side-glide) and referred leg pain and to re-establish LBP interventions (standard PT back care previously known to the patient). The home exercise program (HEP) consisted of a progressive daily aerobic walking program, lumbar stabilization (LS) with transverse abdominus drawing-in maneuver, pelvic floor activation and multifidi recruitment (supine, prone, and quadruped positions), supine 90/90 neural mobilization of the sciatic system, and LE stretching [3-4].

New to this episode of care (EOC) was a group (4-6 participants) TC class which met two times per week for 1-hour sessions over five weeks. The *Movement Awareness and Exercise Class for Patients with Chronic Conditions* is based on the Tai Chi Fundamentals® (TCF) Training program [7]. Developed in collaboration with physical therapists, this medical model of TC has three essential elements: (1) TCF movement patterns (*Basic Moves*), (2) simplified Yang-style *TCF Form* and (3) mind-body principles [7-8].

The TCF *Basic Moves* provide incremental and safe progression of exercise (Figure 1). Taught in a stepwise

neurodevelopmental sequence, the *Basic Moves* provide mid- to high-level balance challenge by: (1) moving the center of mass over the base of support, (2) reducing the base of support from double limb to single limb and (3) decreasing the need for upper extremity support [9]. The *Basic Moves* are qigong ("energy cultivation") exercises that provide building blocks for learning the choreographed flowing sequence of TCF Form. Mind-body principles (mindfulness, diaphragmatic breathing, relaxed nonjudgmental slow movement) were embedded into each TC sessions [8].

Home Exercise Program The patient's final HEP included a 30-45 minute walking (aerobic) program 5-7 days per week, post-walk LE sciatic neural mobilization and lower extremity stretching. The TCF *Basic Moves* and *Form* practiced 4-5 days per week (15 minutes) provided leg strengthening, dynamic lumbar stabilization, postural control and balance exercises for spine health and fall prevention. The patient purchased a DVD for guided home TC practice [10].

Primary Outcome Measures The lumbar component of the *Care Connections (CC)* outcome tool measured functional outcomes [11]. This patient-related outcome tool has functional items comparable to the better known Oswestry Low Back Disability Index (ODI) [12]. The 10-item *CC-lumbar* tool (walking, work, personal care, sleeping, recreation/sports, driving, lifting, standing, squatting, sitting) is scored on a 0 to 100 percent scale, with 100% implying optimal function. A 10-item *CC-lower extremity* (LE) tool (years 2, 5) captured gait characteristics specific to falls risk (up/down stairs and walking on uneven ground). The *CC-improvement index* captured self-perceived recovery on a 10-cm visual analog scale (VAS) and was converted to a percentage (0 to 100 scale).

Secondary Outcome Measures Key body structure and function impairments measured at intake and discharge became secondary outcome measures: pain (10-cm VAS), posture (lateral shift), lumbar range of motion (forward bending), squat capability, LE muscle flexibility and adverse neural tension.

Three-Year Follow-Up Three years following the final episode of care, the patient's functional status was appraised via the *CC-lumbar, CC-LE* and *CC-improvement indices.*

3. Results

3.1 Primary Outcomes

Figure 2 displays *CC-lumbar* outcome data over time (five consecutive years plus 3-year follow-up). The *CC-lumbar* functional index changed 30 percent (54% to 84%) in year 1 (14 individual visits), 16 percent (66% to 82%) in year 2 (12 individual visits) and 20 percent (66% to 86%) in year 5 (4 individual and 10 TC group visits). In year 2, the *CC-LE* functional index demonstrated a modest 14 percent change (68% to 82%), while the addition of TC in year 5 resulted in a distinct 24 percent improvement (64% to 88%). The patient reported her highest rate of overall perceived improvement (90%) in the year with TC training compared to the other years with complete data sets (78% [year 1] and 80% [year 2]).

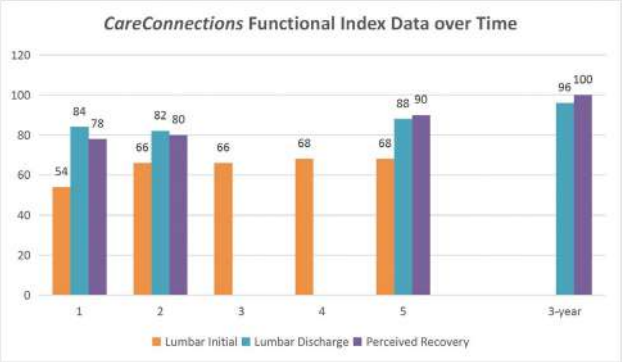

Figure 2. *CareConnections*® Functional Index: Pre- and post-intervention Lumbar Outcomes and Perceived Recovery Index Over Time (8-years)

The *CC-lumbar* outcome tool lacks a published or minimal clinically importance difference (MDIC) or minimum detectable change (MDC). However, 8 of the 10-items are consistent with the more commonly utilized Oswestry LBP Disability Index, which has a MDIC of 12.8.[12] On all PT episodes of care, the client had improvements greater than 12.8% in *CC-lumbar* and *CC-LE* indexes. Adding TC to the standard PT plan of care for persistent LBP resulted in the largest functional gains.

3.2 Secondary Outcomes

Changes in key body structure and function impairments from intake to discharge at the final episode of care (14 visits in 8 weeks) were as follows. Pain (10-cm VAS) improved from 5.7 cm to 1.1 cm on a 0-10 cm scale. Left lateral shift with asymmetric LE weight-bearing posture was abolished by visit 4. Active range of motion of lumbar forward bending, measured fingertips-to-floor, improved from minus 13-inches to minus 3-inches. Functional squat (½ normal depth or knee flexion to 72 degrees) improved to ¾ normal depth squat (110 degrees). Straight leg raise (SLR), used to assess sciatic neural mobility improved 17 degrees (SLR = 53˚to 70˚) on the L LE and 18 degrees (SLR = 48˚to 66˚) on the involved R LE (< 6 percent R/L difference). Thomas test (hip joint angle) assessed 1-joint

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hip flexors (iliopsoas length). The L LE improved 7 degrees (7˚ of hip flexion to neutral or 0˚) and the involved R LE improved 9 degrees (13˚to 4˚). Tight hamstrings measured via supine 90/90 test (knee joint angle) improved 14 degrees (25˚to 11˚) on the L LE and 20 degrees (36˚to 16˚) on the R LE. Ely's test (prone knee bend), with a pillow under the pelvis to accommodate tight 1-joint hip flexors, was used to quantify quadriceps length. Knee joint angle improved 24 degrees (80˚to 104˚) on the L LE and 25 degrees (73˚to 98˚) on the R LE.

3.3 Three-Year Follow-Up

The patient did not return to the health care system for management of any aspect of her LBP for three years. The *CC-lumbar* and *CC-LE* outcome tools, assessed at an unrelated health care visit, both scored 96 percent three years after her last episode of PT care. At this time, the patient rated the self-perceived index of recovery (*CC-improvement index*) at 100 percent (i.e. complete recovery). The patient reported adhering to regular walking program and used several TCF *Basic Moves* as aquatic and land-based exercises. The patient enjoyed family life and worked part time as a realtor (10-12 hours/week) without difficulty. The patient returned to golf (18 holes), a recreational activity that she had not done in over 25 years due to her cLBP. The patient was not formally doing any TCF *Form* practice nor had she sought out a community-based TC program.

4. Discussion

Persistent LBP limits older adults physically (ability to execute routine tasks, exercise or sleep), psychologically (feelings of sadness and irritability, fears about worsening health, loss of hope or depressive symptoms) and socially (isolation, inability to pursue hobbies, reduced self-efficacy) [2,5]. Several factors play a role. Biological influences include age-related sarcopenia, energetic limitations due to senescence of multiple body systems and/or poor nutrition, and maladaptive pain neuroprocessing due to chronicity of pain [2]. Cognitive changes (age-related decline in memory and executive function) and suboptimal social connections may influence the older adult's perception of pain and level of physical activity [2].

Current practice guidelines for the management of persistent LBP are multi-faceted. Physical interventions include aerobic exercise, strengthening, range of motion (flexibility), trunk coordination, neuromuscular control and balance retraining [1-4]. Psychological interventions encompass patient education in the form of pain neuroscience education [13], cognitive-behavioral therapy and mindfulness [1-3,5].

Strength of evidence (SOE) research validates TC for a variety of conditions relevant to older adults [6,14]. Specific to this case, TC has excellent SOE for balance impairment, falls prevention, osteoarthritis and aerobic capacity; good SOE for cardiovascular conditions and strength; and fair SOE for osteoporosis (bone density) and well-being [6]. Few randomized control trials have evaluated its use for LBP [15-17]. A systematic review by the Agency for Healthcare Research and Quality (2016) found that TC was more effective than wait-list control for low back pain intensity (moderate SOE) and function (low SOE) [18]. While several studies support TC for chronic pain, few randomized control trials have evaluated its use for LBP [19]. More high quality trials are needed for recommendation for persistent LBP.

The treatment protocol was based on the movement control approach - a treatment-based classification system used by PT for patients with chronic LBP [4]. Standard PT interventions addressed both local mobility (neural, soft tissue and joint) and global stability impairments (coordination and strengthening of regional musculature relevant to activities of daily living) [4]. Personal practice of TC provided leg strengthening and balance retraining (hip strategies) relevant to the patient's falls risk [6,9,20]. Mind-body skills training and group TC addressed psychosocial aspects of care including mindfulness, cognitive retraining for pain-related fear, and exercise self-efficacy [1-3,5,9].

When confronted with osteoporosis and the risk of fall-related morbidity and mortality, the patient accepted integration of TC into the plan of care. Data strongly support TC as a fall prevention and balance tool in older adults [8,14,20-21]. Simplified Yang-style TC provided a functional exercise strategy capable of addressing the biopsychosocial complexity of the patient's cLBP. Mind-body principles (e.g. mindfulness, postural alignment, breath awareness, active relaxation, slow movement, weight separation and integrated movement from the core) were emphasized (Table 1) [7-8]. Group TC provided a mechanism for mild aerobic exercise, dynamic lumbar stabilization, leg strengthening and flexibility, and functional neuromuscular control, all with the added benefit of contextual (social) support [5,14].

Participants in this group TC class learned TCF *Basic Moves* (Figure 1) over ten 1-hour classes. These exercises can be adapted (e.g. seated, walker support or optional side support versions) to foster safe progression to high-level balance challenge for the older adult with mobility compromise [8]. *Basic Moves* served as incremental building blocks for learning the choreographed flow of TCF *Form* practice. They can be dosed (repetitions, fre-

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Table 1. Tai Chi Mind-Body Principles: Definition and Guidelines for Tai Chi Practice and the Benefits for Persons with persistent Low Back Pain and Falls Risk [8,26,28]

Mind-Body Principles	Definition	Benefits for LBP
Mindfulness (centering)	Nonjudgmental awareness of the present moment	•Somatosensory awareness of body in space (helps with brain re-mapping in persons with chronic pain •Enhanced flow of movement •Relaxation and stress reduction
Postural Alignment	Body upright with symmetrical weight-bearing; emphasis on structural biomechanical alignment of the body	•Slightly flexed knee flexed posture promotes relaxed lumbar posture (inhibits hip flexors to reduce lordosis) •Alignment fosters efficient, functional movements with economy of effort
Breath Awareness	Diaphragmatic breathing (that is natural and relaxed)	•Induces subtle spinal movement that aids kinesthetic awareness •Improved gas exchange (oxygen/carbon monoxide) •Internal organ motility •Promotes calmness and body awareness
Active Relaxation	Awareness of all parts of the body (at one time)	•Release of excessive tension •Efficient (minimal) effort to move the body
Slow Movement	Moving at a slow rate of speed	•Builds strength and endurance
Weight Separation	One leg is full/solid (yang) and one empty/soft (yin)	•Aids balance/coordination •Builds bone density via load (Wolff's law) and piezoelectric effect of muscle contraction
Integrated Movement (from the core)	Movement is initiated at the (core pelvis) or dantian (center of mass) such that movement is fluid motion *(like a string of pearls)*	•Protects the lumbar spine as head, trunk and pelvis remain aligned and move as a single column over the base of support •Enhancing spinal stabilization •Provides solid foundation for upper extremity function

quency and duration) like other strengthening and balance exercises.

TCF *Basic Moves* most relevant to the patient (ones regularly used for long-term aquatic and land-based exercise) included:

(1)*Horse Stance* with *Diaphragmatic Breathing* for mindful postural alignment, optimal lumbar, hip, knee and ankle posture with emphasis on relaxation;

(2)*Bear Rooting* for weight-shifting, hip abductor and knee extensor strengthening and progression to single leg balance;

(3)*Tai Chi 70/30 Stance* with anterior-posterior weight-shifting readily applied to functional activities of daily living;

(4)*Tai Chi Fold* and its variations (Basic Bear, Ski Move) for hip mobility and improved gait and;

(5)*Flying Crane* for single leg strengthening and balance with internal (upper extremity) perturbation for high-level balance challenge.

Many factors influence adherence to exercise in older adults (socioeconomic status, educational levels, gender, marital status, 'good' health and cognitive ability, fewer depressive symptoms and supervised programs) [22]. Older adults adhere to exercise programs to stay independent and safe in activities of daily living. They value exercise and fall prevention programs that promote self-efficacy and self-management [23]. Promoting exercise and self-management strategies for older adults with persistent musculoskeletal pain (particularly geriatric cLBP) should be the common goal of all clinical and community-based exercise programs [24].

TC delivered in an individual or group format (clinic or community-based class) offers a functional exercise strategy to meet physical, psychological, cognitive and social needs of older adults with persistent LBP and falls risk [5-6]. Persons performing TC may expect some delayed onset muscle soreness (DOMS) in anti-gravity musculature (quadriceps, gastrocnemius-soleus complex, hip extensors and abductors) and postural stabilizers (spinal extensors, abdominals, scapular muscles) [8]. TC is a safe exercise; it promotes postural awareness, mental focus and slow, controlled movements that most persons with chronic musculoskeletal conditions can tolerate [25].

TC is a health promoting (salutogenic) exercise. TC masters assert that it provides a practical framework for living a more holistic life by integrating body, mind and spirit [26]. Its mind-body principles help the TC practitioner learn about self, so they can better interact with others.

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The social support and positive interactions (sense of belonging) that come from group TC exercise also merits further evaluation by the scientific community. Data suggests exercise alone reduced the risk of LBP and associated disability; but exercise adherence in the presence of persistent LBP is a formidable barrier for many clients [27].

Study Limitations

This is a case study (level 4 evidence) with limited generalizability to management to all geriatric cLBP. The clinic assessment tool for LBP in this case study (*CC-lumbar* outcome tool), lacks a published MDIC. Comparing the *CC-lumbar* to the Oswestry Low Back Disability Index may not be valid. No formal self-efficacy or balance evaluation tool was administered at any point during patient care. At the 3-year follow-up, the patient reported adhering to a regular walking program and use of TCF *Basic Moves* as aquatic and land-based exercises. As compared to prior trials of standard PT care, TC may have eliminated the need for ongoing PT services; but whether TC mind-body skills or *Basic Moves* attributed to her high level of function is inconclusive.

5. Conclusion

With aging baby boomers, the management of geriatric LBP will be a costly and arduous task for healthcare for decades to come. Much effort has addressed the identification and treatment of the pathoanatomical (biomedical) factors in LBP. Implementation strategies addressing psychosocial risk factors and exercise adherence issues are essential to management. This case report potentiates the use of TC for long-term management of older adults with persistent LBP. The addition of TC to standard back care resulted in significantly decreased pain (5.7 cm to 1.1 cm) and improved body structure (physical impairments) and functional outcomes. Long-term functional recovery was high (96%). The patient reported excellent quality of life (100% improvement index). Simplified TC with its mind-body principles is accessible to patients of all ages and functional abilities. Group TC may address the cognitive, psychological and social needs of older adults with persistent LBP. Group TC practice and billing procedures may offer substantial savings to the health care system versus individualized patient care. Formalized research to determine the efficacy and cost-effectiveness of individual and group TC for geriatric LBP is warranted.

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This document provides some guidelines to authors for submission in order to work towards a seamless submission process. While complete adherence to the following guidelines is not enforced, authors should note that following through with the guidelines will be helpful in expediting the copyediting and proofreading processes, and allow for improved readability during the review process.

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- Program: Microsoft Word (preferred)
- Font: Times New Roman
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- Paragraph: Justified
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All articles should include a cover letter as a separate document.

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v Conflict of Interest

Examples of conflicts of interest include (but are not limited to):

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This section confirms that written consent was obtained from all participants prior to the study.

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Supplementary figures, small tables, text etc.

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In this section, the results of the experiments conducted can be discussed in detail. Authors should discuss the direct and indirect implications of their findings, and also discuss if the results obtain reflect the current state of research in the field. Applications for the research should be discussed in this section. Suggestions for future research can also be discussed in this section.

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Ⅺ. Glossary of Publication Type

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Conflicts of interest, acknowledgements, and publication ethics should also be declared in the final version of the manuscript. Instructions have been provided as its counterpart under Cover Letter.

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