



Silesians in Texas and Upper Silesia: anthropometric, functional and physical activity characteristics

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ABSTRACT: Anthropometric, functional and physical activity characteristics of contemporary adult descendants of Upper Silesian immigrants to Texas in the mid-19th century and current residents in Upper Silesia were compared. The sample included 45 residents in Central Texas, 25 women and 20 men, and 36 residents in rural Upper Silesia, 24 women and 12 men, 54–76 years of age. Variables included selected demographic characteristics, anthropometry, estimated body composition, several physiological indicators, strength and functional fitness, and physical activity. Sex-specific MANCOVA and Chi square were used for comparisons. Descendants of Silesian immigrants to Texas were taller, on average, while differences in other anthropometric variables were variable. All residents in Silesia and the majority of descendants of Silesian migrants to Texas were overweight or obese. Differences in hemodynamic and respiratory functions and responses to a 6-minute walk were inconsistent, while none of the fitness variables differed significantly between the samples. Although residents in Upper Silesia were significantly more physically active descendants of Silesians in Texas, >80% of the men and women in both samples scored below the criterion-reference standard for the maintenance of physical independence in the 6-minute walk.

KEY WORDS: aging, functional fitness, physical activity, weight status, respiratory function

Introduction

Studies of the physical characteristics of migrants have a long history in anthropology (Boas 1911, 1912; Shapiro 1939;

Goldstein 1943; Lasker 1952, 1954; Lanfear 2012). Early studies (Boas 1911, 1912) were focused on changes in the morphology of immigrants and descendants in the United States as they adapt-

ed their new environments. Other studies considered the representativeness of migrants relative to the population from which they had emigrated (Shapiro 1939; Illsley et al. 1963); physical differences between adults migrants and sedentes (Hulse 1969; Goldstein 1943; Lasker 1952, 1954) and to a lesser extent in child migrants and sedentes (Scottish Council for Research in Education 1953; Malina et al. 1982); and the influence of migration on population genetic structure (Spuhler 1976; Little et al. 1989).

Following the genre of Boas (1910, 1912), Rosiński (1934a, 1934b, 1934c) considered the descendants of Polish migrants in Texas in 1929 and 1930. The initial migration of Poles from the region of Upper Silesia (part of the Kingdom of Prussia) to Central Texas occurred in 1854 (Dworaczyk 1936) and a subsequent migration from western Małopolska (western part of the Kingdom of Austria) to region north of Houston, Texas, occurred in the 1870s. Consistent with other studies of the period, the study of Rosiński was largely typological with a focus on craniofacial dimensions, although height was measured. The study compared the heights and craniofacial dimensions of migrants who were born in Silesia/Małopolska with those of descendants of the migrants born in Texas. The latter were, on average, taller than migrants born in Silesia/Małopolska (Rosiński 1934a).

The purpose of the present study is to compare the anthropometric, functional and physical activity characteristics, and indirectly the health status of adult descendants of Upper Silesian immigrants to Texas in the mid-19th century with those current residents in Upper Silesia. Both samples were surveyed in 2013 and 2014.

Methods

Background

Poland did not politically exist at the time of the migration of residents from Upper Silesia to Texas in the mid-19th century. Upper Silesia was in the sector of Poland that was part of the Kingdom of Prussia. German and Czech migrants from the Kingdom of Prussia preceded the Polish migrants in Central Texas in the 1840s, and Fr. Leopold Moczygemba, who was of Silesian ancestry, was sent to minister to Bavarian Catholics in Central Texas in the early 1950s. Given the opportunities in the region at the time, Fr. Moczygemba encouraged his relatives and friends in Upper Silesia to migrate to Texas. The first wave of Polish migrants arrived in Panna Maria, south of San Antonio in Central Texas in December 1854 (Dworaczyk 1934; Przygoda 1971; Brożek 1972; Baker 1975, 1979, 1982; Dawson et al. 2004). It was estimated that the initial migration into the region included 65 families. Over the next two years, three other migrations of Poles from Upper Silesia followed, 16 families in February 1855, 700 individuals in December 1855, and 30 families at the end of 1856 (Przygoda 1971). The migrants settled in the same region as the initial migrants and also other areas of central Texas and the region south of it.

Ethics

The project was approved by the Senate Commission on Ethics in Scientific Research at the University of Physical Education in Wrocław on February 18, 2009. All subjects provided written informed consent, to participate in the study.

Participants

The study was conducted in 2013 and 2014 in two locations: the city of San Antonio and surrounding communities in the state of Texas, United States, and Strzelce Opolskie in Upper Silesia, Poland. As noted, Polish migrants to Texas from Silesia in the mid-19th century initially settled in Panna Maria, about 50 miles (80 km) south of the city of San Antonio. Subsequently and over time, the early migrants and descendants moved to other communities in the region. With the assistance of a local priest of Polish ancestry, a sample of 45 individuals of Silesian origin were identified, 25 women and 20 men. To be included, the individuals had to be fifth generation descendants of the initial migrants to Texas from the territory of Upper Silesia in the 19th century. This was verified on the basis of detailed interview with the descendants of the emigrants. The criterion required that they trace their origin to marriages between women and men of Polish immigrants from Silesia, and in subsequent generations of marriages between descendants of immigrants from Silesia. Twelve individuals lived in San Antonio, 24 lived in seven towns in the vicinity of Panna Maria (largely to the north-northeast), and 9 lived in three towns east-southeast of San Antonio. The average age of the women was 68.3 ± 4.8 years and that of the men was 69.0 ± 3.7 years.

The Silesian sample in Poland included 36 residents in Upper Silesia, 24 women and 12 men, who lived in a rural area. The average age of the women was 63.1 ± 4.4 years and that of the men was 64.8 ± 4.2 years. Silesian migrants to Texas in the mid-1850s were from this region, and the descendants of Silesian mi-

grants to Texas in the present study were recruited from families whose histories included ancestors who had migrated from Silesia to Texas.

Procedures

All subjects initially completed a questionnaire which included date of birth, place of residence, education, indicators of socio-economic status (SES), health status and use of alcohol and/or tobacco. Each participant was also interviewed about his/her health status. Other specific information was obtained by measurement or questionnaire as noted below.

Anthropometry and Body Composition

Weight was measured to the nearest 0.1 kg using a unit that included an anthropometer; standing height was measured to the nearest 0.1 cm with this unit (model 764, SECA, Hamburg, Germany). Waist and hip circumferences were measured to the nearest 0.1 cm over clothing (with firm pressure applied) at the level of the umbilicus and greater trochanters, respectively. The triceps, subscapular and abdominal skinfolds were measured to the nearest 1 mm using a Harpenden caliper (Harpenden Skinfold Caliper Company GMT). The body mass index (BMI, kg/m^2), waist-hip ratio, and the sum of the three skinfolds were calculated.

Body composition was estimated using a near-infrared interactance with a Futrex analyzer (Flowscreen, Jaeger, Wuerzburg, Germany, version 1.3). Relative (%) and absolute (kg) fat mass, fat-free mass (FFM, kg) and total body water (TBW, liters) were estimated. Relative fatness and FFM were used in the analysis.

Physiological Indicators

Diastolic and systolic blood pressures and heart rate were recorded using a M10-IT monitor (Omron, CITY, The Netherlands). Blood pressures and heart rate were measured at rest before a six-minute walk, and at 1 and 5 minutes after the walk. The walking area was a specially marked section of a corridor marked for a walking distance of 30 meters. The subject walked at a self-selected pace and was informed of the distance covered during the walk.

Respiratory function was assessed with the Masterscreen Spirometry system (Jaeger, Germany) following the standards of the American Thoracic Society (Miller et al., 2005). After familiarizing the participants with the procedures, forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1) and peak expiratory flow (PEF) were measured. The absolute values were compared relative to reference norms published by the European Coal and Steel Community (Quanjer et al. 1993) and integrated with the Masterscreen Spirometer. FVC and FEV1 values used to determine the presence of restrictive or obstructive lung disease.

Functional Fitness

The six items of the Functional Senior Fitness Test (Rikli and Jones 2001) were administered: upper (arm curl) and lower (chair stand) body strength, cardiovascular endurance (6-min walk), agility and dynamic balance (8-foot up-and-go), and upper (back scratch) and lower (sit and reach) body flexibility. Details of the tests have been reported (Ignasiak et al. 2017).

Physical Activity

Level of physical activity (PA) was estimated with the short form of the International Physical Activity Questionnaire (IPAQ). The IPAQ short form considers PA over the past seven days and includes seven questions asking for number of days spent in three PA formats (vigorous, moderate and walking) and time spent (hours, minutes) in each format. The last question asked for time spent sitting on a weekday; unfortunately, many responses for the last question were incomplete or lacking.

Days per week and hours per day spent in vigorous and moderate PA and walking, and total time in PA in hours per week were calculated. Estimated MET minutes per week (MET min/wk) in PA were also calculated and used to classify the weekly PA of each individual following Biernat et al. (2007): insufficient, <600 MET min/wk; sufficient, >600 <3000 MET min/wk; high, >3000 MET min/wk.

Statistical Analysis

Descriptive statistics were calculated by sex for the descendants of Silesian immigrants to Texas and contemporary residents in Upper Silesia; age differed significantly within each sex. Sex-specific MANCOVA, with age and age squared as covariates, was thus used to compare the descendants of Silesian immigrants to Texas and contemporary residents in Upper Silesia. Age and age squared adjusted for potential linear and non-linear effects of age distributions, respectively. Chi square was used in comparisons of categorical variables. Analyses were done with SPSS for Windows (version 22.0, IBM SPSS, Chicago, IL). Statistical significance was set at $p < 0.05$.

Results

Allowing for the relatively small sample sizes, selected demographic characteristics and two health-related behaviors are generally similar within each sex, except for level of education (Table 1). All descendants of Silesians in Texas have a secondary or higher education, whereas residents in Upper Silesia are distributed between basic/vocational and secondary/higher education.

Anthropometric and body composition characteristics of the two samples are summarized in Table 2. As noted earlier, age differs significantly between groups in each sex. After controlling for age among males, only one variable differs significantly between descendants of Silesian migrants to Texas and residents in Upper Silesia. Sitting height is significantly taller among men in Texas ($p < 0.05$). Allowing for the small sample

of Silesian males, age-adjusted means for weight, height, sitting height, BMI, waist circumference and estimated FFM are greater among descendants of Silesian migrants to Texas; on the other hand, hip circumference and the sum of three skinfolds are larger in residents of Upper Silesia. The distribution of the two groups of males by weight status does not differ significantly ($\chi^2 = 1.92$). All 12 Silesian men are either overweight (5) or obese (7); the majority of the Texas sample is also overweight (5) or obese (13); two men were of normal weight.

Among females, on the other hand, descendants of Silesian migrants to Texas are significantly taller ($p < 0.01$) and have a greater sitting height ($p < 0.01$), while residents in Upper Silesia have a significantly higher BMI, waist circumference, sum of skinfolds, relative fatness, and waist-hip ratio ($p < 0.05$). All women in the Silesian sample are either overweight

Table 1. Selected demographic characteristics of descendants of Silesian immigrants to Texas and contemporary Silesian residents in Poland (Upper Silesia)

	Females Silesians in		Males Silesians in	
	Texas	Poland	Texas	Poland
Marital status				
Married	64%	83%	85%	92%
Not married	36	17	15	8
Education				
Basic/Vocational	0	63	0	50
Secondary/Higher	100	37	100	50
Self-reported health status				
Very good	19	4	16	0
Good	79	83	80	92
Poor	2	13	5	8
Alcohol consumption				
Yes/often	4	13	60	25
No/occasionally	96	87	70	75
Cigarette smoking				
Yes	0	4	90	83
No	100	96	10	17

Table 2. Age, anthropometric characteristics and estimated body composition (means, standard deviations) of descendants of Silesian migrants to Texas and contemporary residents in Upper Silesia, Poland, results of ANOVA (age) and MANCOVA (all other variables; age and age-squared as covariates) and age-adjusted means and standard errors

	Males												Females											
	Silesians in Texas (n=20)						Silesians in Poland (n=12)						Silesians in Texas (n=25)						Silesians in Poland (n=24)					
	M		SD		SE		M		SD		SE		M		SD		SE		M		SD		SE	
Age, yrs	69.0	3.7	64.8	4.2	8.79**							68.3	4.8	63.1	4.4	15.49**								
Height, cm	173.1	5.9	171.1	3.9	2.49	173.7	1.3	170.1	1.7	170.1	1.7	164.0	4.8	157.2	4.5	31.22**	164.8	1.0	156.5	1.0	156.5	1.0	156.5	1.0
Weight, kg	95.0	15.9	89.7	10.1	0.83	95.2	3.5	89.4	4.7	89.4	4.7	78.8	16.2	81.5	13.1	0.82	78.0	3.1	82.3	3.2	82.3	3.2	82.3	3.2
BMI, kg/m ²	31.6	4.6	30.6	2.8	0.08	31.5	1.0	30.9	1.4	30.9	1.4	29.3	6.1	33.1	5.8	6.38*	28.7	1.3	33.7	1.3	33.7	1.3	33.7	1.3
Sitting ht, cm	91.2	2.5	90.0	2.3	5.34*	91.6	0.5	89.3	0.7	89.3	0.7	87.1	3.1	83.7	3.5	16.60**	87.6	0.7	83.2	0.7	83.2	0.7	83.2	0.7
Sit ht ratio	52.7	1.1	52.6	0.8	0.28	52.7	0.3	52.5	0.3	52.5	0.3	53.1	1.5	53.3	1.7	0.00	53.2	0.4	53.2	0.4	53.2	0.4	53.2	0.4
Waist c, cm	105.9	13.1	103.6	8.4	0.19	105.9	2.9	103.6	3.9	103.6	3.9	89.6	13.5	96.6	10.5	5.10*	88.7	2.6	97.6	2.6	97.6	2.6	97.6	2.6
Hip c, cm	107.6	7.6	109.1	7.6	0.95	106.9	1.9	110.2	2.5	110.2	2.5	112.0	13.4	114.0	12.0	1.24	110.7	2.7	115.3	2.8	115.3	2.8	115.3	2.8
WH ratio	0.98	0.07	0.95	0.04	2.89	0.99	0.01	0.94	0.02	0.94	0.02	0.80	0.08	0.85	0.06	4.59*	0.80	0.01	0.85	0.01	0.85	0.01	0.85	0.01
Sum skf, mm	64.1	19.1	72.4	16.5	1.36	63.7	4.5	73.2	6.1	73.2	6.1	83.5	28.1	98.9	26.4	3.80*	82.5	5.7	99.6	6.0	99.6	6.0	99.6	6.0
Fat, %	32.0	5.6	29.4	4.6	0.15	31.4	1.3	30.5	1.7	30.5	1.7	40.7	5.4	43.3	2.9	8.38**	40.0	0.9	44.0	0.9	44.0	0.9	44.0	0.9
FFM, kg	63.8	6.8	63.0	4.3	0.93	64.5	1.5	61.9	2.0	61.9	2.0	46.0	6.0	45.9	6.1	0.00	46.0	1.3	45.9	1.3	45.9	1.3	45.9	1.3

*p<0.05, **p<0.01

Table 3. Diastolic (DBP) and systolic (SBP) pressures at rest, heart rate (HR) before and immediately after and 5 minutes after exercise (means, standard deviations), and lung function (FVC – forced vital capacity, FEV – forced expiratory volume, PEF – peak expiratory force) of descendants of Silesian migrants to Texas and contemporary residents in Upper Silesia, Poland, results of MANCOVA (age and age-squared as covariates) and age-adjusted means and standard errors

	Males												Females											
	Silesians in Texas (n=20) ¹						Silesians in Poland (n=12)						Silesians in Texas (n=25)						Silesians in Poland (n=24)					
	M		SD		SE		M		SD		SE		M		SD		SE		M		SD		SE	
	M	SD	M	SD	M	SE	M	SD	M	SD	M	SE	M	SD	M	SD	M	SE	M	SD	M	SE	M	SE
DBP, mmHG	84	6	91	3	8.54**	84	1	91	1	84	10	87	8	0.07	85	2	86	2	0.07	85	2	86	2	
SBP, mmHG	147	13	159	14	7.01*	146	3	162	4	143	15	150	17	1.22	143	3	149	4	1.22	143	3	149	4	
HR rest, bpm	74	11	77	10	2.13	72	3	79	4	72	10	73	12	0.04	73	2	72	2	0.04	73	2	72	2	
HR after, bpm	98	14	100	21	0.30	97	3	101	6	97	17	101	18	0.65	97	4	101	4	0.65	97	4	101	4	
HR recovery, bpm	76	11	83	13	1.53	76	3	83	4	78	77	76	16	0.14	78	3	76	3	0.14	78	3	76	3	
FVC, liters	2.7	0.7	4.0	0.6	10.95**	2.9	0.2	3.8	0.2	3.5	1.1	2.9	0.4	5.21*	3.6	0.2	2.9	0.2	5.21*	3.6	0.2	2.9	0.2	
FVC, %	102	15	102	14	0.16	101	4	104	5	108	21	114	15	0.17	110	4	112	4	0.17	110	4	112	4	
FEV1, liters	2.2	0.6	3.0	0.6	6.99*	2.2	0.1	2.9	0.2	2.7	0.9	2.2	0.4	6.62*	2.7	0.1	2.1	0.1	6.62*	2.7	0.1	2.1	0.1	
FEV1, %	97	16	97	19	0.35	95	4	100	6	104	18	101	18	0.46	105	4	101	4	0.46	105	4	101	4	
FEV1/FVC, %	70	10	70	8	0.29	69	2	71	3	72	9	68	8	3.86*	73	2	67	2	3.86*	73	2	67	2	
PEF, l/s	4.2	1.7	6.4	1.8	6.75*	4.3	0.4	6.2	0.6	4.7	1.8	4.1	0.7	0.80	4.6	0.3	4.2	0.3	0.80	4.6	0.3	4.2	0.3	
PEF, %	71	19	80	22	4.49*	67	5	86	6	65	19	70	13	0.60	65	4	69	4	0.60	65	4	69	4	

*p<0.05, **p<0.01.

¹n = 19 for indicators of lung function.

Table 4. Grip strength and functional fitness (means, standard deviations) of descendants of Silesian migrants to Texas and contemporary residents in Upper Silesia, Poland, results of MANCOVA (age and age-squared as covariates) and age-adjusted means and standard errors

	Males												Females																									
	Silesians in Texas (n=20) ¹						Silesians in Poland (n=12)						Silesians in Texas (n=25)						Silesians in Poland (n=24)																			
	M		SD		SE		M		SD		SE		M		SD		SE		M		SD		SE															
	M	SD	M	SD	M	SE	M	SD	M	SD	M	SE	M	SD	M	SD	M	SE	M	SD	M	SE	M	SE														
Dominant grip, kg	46.1	10.5	47.8	4.3	0.52	47.6	1.7	45.4	2.3	28.4	6.0	33.1	6.4	0.57	30.1	1.2	31.4	1.2	0.50	0.15	0.54	0.09	0.01	0.52	0.03	0.51	0.04	2.3	0.04	0.37	0.10	0.41	0.11	0.13	0.40	0.02	0.39	0.02
Grip/weight, kg/kg	0.73	0.18	0.76	0.09	0.04	0.75	0.03	0.73	0.04	0.63	0.14	0.73	0.15	0.52	0.66	0.03	0.69	0.03	0.73	0.18	0.76	0.09	0.04	0.75	0.03	0.73	0.04	0.63	0.14	0.73	0.15	0.52	0.66	0.03	0.69	0.03		
Chair stands, n/30 sec	15.3	4.1	16.9	4.2	0.57	15.4	0.9	16.7	1.3	13.3	2.9	15.9	5.4	0.48	14.1	0.9	15.0	0.9	16.9	4.1	16.9	4.2	0.57	15.4	0.9	16.7	1.3	13.3	2.9	15.9	5.4	0.48	14.1	0.9	15.0	0.9		
Arm curls, n/30 sec	16.9	4.0	20.3	3.6	3.56	17.0	0.9	20.1	1.2	17.4	3.5	17.1	3.8	2.50	18.1	0.7	16.3	0.7	20.3	3.6	20.3	3.6	3.56	17.0	0.9	20.1	1.2	17.4	3.5	17.1	3.8	2.50	18.1	0.7	16.3	0.7		
6-min walk, m	484	74	560	85	2.45	493	18	544	24	485	88	509	58	0.15	492	16	502	17	560	85	560	85	2.45	493	18	544	24	485	88	509	58	0.15	492	16	502	17		
Up & go, sec	6.34	1.0	5.65	1.0	0.00	6.08	0.2	6.08	0.3	6.58	1.1	6.35	1.4	0.17	6.38	0.3	6.55	0.3	5.65	1.0	5.65	1.0	0.00	6.08	0.2	6.08	0.3	6.58	1.1	6.35	1.4	0.17	6.38	0.3	6.55	0.3		
Chair sit & reach, cm	-6.9	6.7	-5.6	9.2	0.89	-7.6	1.9	-4.4	2.5	-0.3	6.6	1.3	5.5	0.13	0.1	1.3	0.8	1.4	-6.9	6.7	-5.6	9.2	0.89	-7.6	1.9	-4.4	2.5	-0.3	6.6	1.3	5.5	0.13	0.1	1.3	0.8	1.4		
Back scratch, cm	-12.5	15.3	-11.2	10.6	0.23	-13.0	3.3	-10.2	4.4	-2.2	8.6	-3.9	4.9	2.37	-1.3	1.5	-4.8	1.5	-12.5	15.3	-11.2	10.6	0.23	-13.0	3.3	-10.2	4.4	-2.2	8.6	-3.9	4.9	2.37	-1.3	1.5	-4.8	1.5		

¹p<0.05, ^{**}p<0.01.

(7) or obese (17), while the weight status of Silesian descendants in Texas 9 of normal weight, 5 overweight and 11 obese ($\chi^2 = 10.60$, $p < 0.01$).

Hemodynamic and respiratory characteristics of the two samples are summarized in Table 3. Diastolic blood pressure is significantly higher in Upper Silesia males ($p < 0.1$), while systolic blood pressure and heart at rest and after exercise do not significantly differ between male descendants of Silesian migrants to Texas and residents in Upper Silesia. Similarly, blood pressures and heart rate at rest and after exercise do not differ significantly between the two samples of females.

Indicators of respiratory function (Table 3) differ significantly between the samples. FVC (liters, $p < 0.01$), FEV1 (liters, $p < 0.05$) and PEF (liters/sec, $p < 0.05$) are significantly higher in male residents in Upper Silesia, while FVC, FEV1 and PEF are significantly higher in female descendants of Silesian migrants to Texas ($p \leq 0.05$). The three relative respiratory function indices (FVC %, FEV1 %, FEV1/FVC, %) do not significantly differ between males and females of Silesian ancestry in Texas and in Poland. PEF % is significantly higher among Silesian males in Poland ($p < 0.05$), but does not differ between the two samples of females.

Compared to norms (European Coal and Steel Community, 1983) for relative FVC, all Upper Silesian males and females are classified as normal, while 1 of 20 males and 3 of 24 females among the descendants of Silesian migrants to Texas are classified as having some degree of pulmonary restriction. The differences are not significant (males, $\chi^2 = 0.62$, $p = 0.43$; females, $\chi^2 = 4.18$, $p = 0.12$). Corresponding comparisons for FEV1 indicate similar results; 1 of 12 males

and 2 of 24 females in the Upper Silesian samples, and 1 of 20 males and 2 of 25 females in the Texas samples are classified as having some degree of pulmonary obstruction compared. The differences also are not significant (males, $\chi^2 = 0.14$, $p = 0.71$; females, $\chi^2 = 0.98$, $p = 0.61$).

Grip strength and the functional fitness of descendants of Silesian migrants to Texas and contemporary residents in Upper Silesia are summarized in Table 4. None of the fitness variables, including grip strength, differ significantly between descendants of Silesian migrants to Texas and residents in Upper Silesia among both males and females. Relative to norms for U.S. adults 65+ years of age, i.e., below, at [normal] or above the reference (Jones and Rikli 2002), distributions of descendants of Silesian migrants to Texas and Silesians resident in Upper Silesia do not differ except for upper body strength and agility in males and upper back flexibility in females (Table 5). Significantly more males in the Texas sample score below normal in the arm curl and agility, while proportionally more males in the Upper Silesia sample score above normal in the arm curl. On the other hand, significantly more females in the Texas sample score above normal in upper body flexibility (back scratch) compared to Upper Silesian females.

Estimated levels of PA among Silesian descendants in Texas and Silesians in Poland based upon the IPAQ short-form questionnaire are summarized in Tables 6A (males) and 6B (females). Given the variability in self-reported levels of PA, days and time spent in vigorous and moderate PA do not differ significantly between Silesian descendants in Texas and Silesians in Poland in both sexes, respectively. However, estimated days

and time walking, total PA (hrs/wk), and MET min/wk differ significantly (males $p \leq 0.05$; females $p < 0.01$). Silesian males and females in Poland are significantly more active than male and female descendants of Silesians in Texas. Silesian

males are about twice as active as male descendants of Silesians in Texas, while Silesian females are more than three times as active as female descendants of Silesians in Texas. Based on the criteria of Berniat et al. (2007), all Silesian

Table 5. Functional status (frequencies) of descendants of Silesian immigrants to Texas and contemporary Silesian residents in Poland (Upper Silesia) relative to norms for U.S. adults 65+ years of age (Jones and Rikli 2002)

	Males Silesians in		Females Silesians in	
	Texas (n=20)	Poland (n=12)	Texas (n=25)	Poland (n=14)
Lower body strength (chair stand)				
Below	2	2	2	2
Normal	14	5	18	15
Above	4	5	5	6
Chi square	2.53		0.54	
Upper body strength (arm curl)				
Below	6	1	1	1
Normal	13	6	15	15
Above	1	5	9	8
Chi square	7.27*		0.04	
Aerobic endurance (6 min walk)				
Below	17	9	16	15
Normal	3	2	7	9
Above	0	1	2	0
Chi square	1.77		2.26	
Agility (8 foot up-&-go)				
Below	14	3	11	12
Normal	6	9	14	9
Above	0	0	0	3
Chi square	6.10*		4.11	
Lower back flexibility (sit & reach)				
Below	13	7	7	2
Normal	6	3	15	17
Above	1	2	3	5
Chi square	1.21		3.38	
Upper back flexibility (back scratch)				
Below	11	4	12	12
Normal	5	5	3	10
Above	4	3	10	2
Chi square	1.50		9.09*	

Table 6A. Means (M), standard errors (SE), medians (Md) and ranges for indicators of physical activity (PA) after IPAQ (short form) among MALE descendants of Silesian immigrants to Texas and contemporary Silesian residents in Poland (Upper Silesia), and results of the MANCOVA controlling for age and age squared, and age-adjusted means (M) and standard errors (E)

	Silesians in Texas (n=19)				Silesians in Poland (n=12)				Silesians in: Texas				Poland		
	M	SD	Md	Range	M	SD	Md	Range	F	M	SE	M	SE	M	SE
	Vigorous PA	1.8	2.0	2.0	0-6	2.3	2.7	1.5	0-7	0.00	2.02	0.53	1.97	0.69	1.97
Days/week, n	1.3	1.7	1.0	0-4	2.9	3.4	1.5	0-9	1.16	1.50	0.56	2.58	0.74	2.58	0.74
Hrs/day	3.3	2.4	4.0	0-7	3.3	2.4	3.0	0-7	0.00	3.28	0.62	3.31	0.81	3.31	0.81
Moderate PA	1.8	1.4	2.0	0-4	3.1	2.9	2.3	0-8	1.00	1.93	0.52	2.86	0.69	2.86	0.69
Days/week, n	4.8	2.3	5.0	0-7	6.7	0.6	7.0	1-10	5.06*	4.83	0.46	6.68	0.61	6.68	0.61
Hrs/day	1.8	1.7	1.5	0-8	4.7	2.4	5.0	1-12	6.27*	2.10	0.49	4.26	0.64	4.26	0.64
PA Total, hrs/wk	21.3	15.5	20.0	0-64	59.3	34.8	63.0	14-126	6.60*	26.16	5.86	52.34	7.67	52.34	7.67
MET units, min/wk	5780	4531	5172	0-19152	16012	12030	14781	4518-38610	3.96*	7051	1972	14001	2577	14001	2577

*p ≤ 0.05

Table 6B. Means (M), standard errors (SE), medians (Md) and ranges for indicators of physical activity (PA) after IPAQ (short form) among FEMALE descendants of Silesian immigrants to Texas and contemporary Silesian residents in Poland (Upper Silesia), and results of the MANCOVA controlling for age and age squared, and age-adjusted means (M) and standard errors (E)

	Silesians in Texas (n=19)				Silesians in Poland (n=12)				Silesians in: Texas				Poland		
	M	SD	Md	Range	M	SD	Md	Range	F	M	SE	M	SE	M	SE
	Vigorous PA	1.3	2.1	0.0	0-7	2.5	2.4	2.5	0-7	0.43	1.66	0.48	2.14	0.49	2.14
Days/week, n	0.8	1.5	0.0	0-6	1.4	2.1	1.0	0-10	0.36	1.26	0.35	0.9	0.36	0.9	0.36
Hrs/day	1.5	1.9	1.0	0-7	3.1	2.7	3.0	0-7	1.47	1.84	0.49	2.75	0.50	2.75	0.50
Moderate PA	1.0	1.6	0.0	0-6	2.1	2.2	1.5	0-9	1.49	1.12	0.40	1.88	0.41	1.88	0.41
Days/week, n	3.2	2.6	3.0	0-7	6.7	1.3	7.0	1-7	21.32*	3.39	0.44	6.51	0.45	6.51	0.45
Hrs/day	1.5	1.6	1.0	0-7	6.0	3.0	6.0	1-10	27.23*	1.68	0.52	5.86	0.54	5.86	0.54
PA Total, hrs/wk	12.3	19.1	4.0	0-81	57.6	27.2	53.0	15-126	26.04*	15.32	5.02	54.52	5.14	54.52	5.14
MET units, min/wk	3009	4105	1440	0-13896	13309	8161	11371	3318-41916	15.66*	4063	1347	12211	1378	12211	1378

*p < 0.01.

males ($n=12$) and females ($n=24$) have a high level of weekly PA (>3000 MET min/wk) compared to 12 of 19 males of Silesian ancestry in Texas ($\chi^2 = 4.70, p = 0.09$) and to 8 of 25 females of Silesian ancestry in Texas ($\chi^2 = 25.00, p < 0.001$).

Discussion

Allowing for the relatively small sample sizes, comparisons of descendants of Silesians in Texas and residents in Upper Silesia suggest several trends. Among selected demographic characteristics, only one differs between the groups. All descendants of Silesians in Texas had completed secondary or higher education, while residents in Upper Silesia had a basic/vocational or secondary/higher education (Table 1).

Although not statistically significant and allowing for the relatively small samples, male descendants of Silesian immigrants to Texas were, on average, taller and heavier with a higher BMI and estimated FFM than residents in Upper Silesia. Female descendants of Silesian immigrants to Texas were taller, while residents in Upper Silesia had a higher

BMI, waist circumference, sum of skin-folds and relative fatness (Table 2).

As noted earlier, Rosiński (1934a, 1934b, 1934c) studied the heights and craniofacial dimensions of immigrants from Silesia in the 1850s (Kingdom of Prussia) and from Małopolska in the 1870s (Kingdom of Austria) to Texas and descendants of the respective immigrants to Texas in 1929–1930. Age ranges and heights of the Polish immigrants to Texas and descendants of the immigrants to Texas in 1929–1930 and of the descendants of Silesian immigrants to Texas and residents in Upper Silesia in the present study (2013–2014) are compared in Table 7. Allowing for variation in ages of the subjects at the time of the respective surveys, several trends are suggested. First, descendants of immigrants of both sexes to Texas in 1929–1930 were, on average, taller than those who immigrated. Second and allowing for the small samples, descendants of immigrants of both sexes to Texas in 2013–2014 were, on average, taller than contemporary residents in Silesia. Third, male descendants of immigrants to Texas in 1929–1930 and in 2013–2014 did

Table 7. Sample sizes, age ranges and means (M) and standard deviations (SD) for the heights of Polish immigrants to Texas and descendants of immigrants to Texas in 1929–1930 and descendants of Silesian immigrants to Texas and residents in Upper Silesia, Poland in 2013–2014*

Year of survey	Immigrants from Silesia/Małopolska to Texas and Current Residents of Upper Silesia					Descendants of Immigrants to Texas			
	Residence	N	Age range	Height, cm M	SD	N	Age range	Height, cm M	SD
Males									
1929–30	Texas	96	38–83	167.0	6.6	464	18–68	173.6	5.9
2013–14	Silesia	12	59–75	171.1	3.9	20	63–76	173.1	5.9
Females									
1929–30	Texas	86	38–75	155.9	4.7	449	18–68	160.1	5.3
2013–14	Silesia	24	54–70	157.2	4.5	25	60–75	164.0	4.8

*Data for 1929–1930 are from Rosinski (1934a). The age ranges of the immigrants and descendants of immigrants were estimated from graphs comparing the heights of the groups.

not differ in mean heights, while female descendants of immigrants to Texas in 2013–2014 were, on average, taller than descendants of immigrants to Texas in 1929–1930.

The weight status and health-related behaviors of the small samples in the present study merit attention. All Silesian men and women were classified as overweight or obese based on the BMI. The majority of descendants of Silesian immigrants to Texas were similarly classified, although two men and nine women were of normal weight. On the other hand, residents of both sexes in Upper Silesia were significantly more physically active than male and female descendants of Silesians in Texas; the differences were especially apparent in walking, total physical activity during the week and estimated MET units expressed as min/week (Table 6). The lower physical activity levels of the descendants of Polish immigrants living in Texas were likely-related to lifestyle differences, specifically those related to subsistence and occupation. The observations for descendants living in Texas were, nevertheless, consistent with the relatively low levels of physical activity among older adults in the U.S. (Kruger et al. 2007; U.S. Department of Health and Human Services 2010).

In contrast to the observations for physical activity, none of the fitness variables, including grip strength, differed significantly between descendants of Silesian migrants to Texas and residents in Upper Silesia in both males and females (Table 4). Relative to norms of the fitness tests for U.S. adults 65+ years of age (Jones and Rikli 2002) there were no consistent trends in either sample (Table 5), although the 6-minute walk, an indicator of aerobic endurance, mer-

its attention. In both groups of males and females and allowing for the small numbers, the overwhelming majority of subjects (>80%) scored below the criterion-reference standards for the maintenance of physical independence in the 6-minute walk (Rikli and Jones 2012). Among Polish adults 60–87 years, in contrast, 39% of males and 53% of females did not meet the age- and sex-specific criteria for the 6-minute walk (Ignasiak et al. 2017). The results for the present study were especially surprising given the differences in physical activity between descendants of Silesian migrants to Texas and residents in Upper Silesia in both males and females (Table 6). Residents in Upper Silesia walked significantly more and overall had greater estimated levels of physical activity per week than descendants of Silesian migrants to Texas.

Although there is interest in potential links between factors associated with migration and subsequent health status (Benthan 1988; Deverteuil et al. 2007; Heller et al. 2002; Moorin et al. 2006; Marshall et al. 1999; Potter et al. 2001; Szklarska et al. 2008), this question cannot be addressed in the present study as about five or six generations have elapsed since the migration of the Silesians to Texas in the 1850s, in addition to the small samples. Moreover, studies addressing potential links between factors related to migration and subsequent health concern mainly contemporary migrants and in some cases internal migrants within a country.

Nevertheless, there is interest-intergenerational mobility in earnings and economic status (Chetty et al. 2014; Yuksel 2007; Ferrie 2005; Corak 2004; Solon 1992; Zimmerman 1992), both of which are factors associated with health

status and outcomes. Currently available data, however, do not span five or six generations. A recent study of mothers and their children across three generations based on national survey data in the United States highlighted the importance of maternal health outcomes which persisted across generations, e.g., BMI and specific health conditions such as asthma and depression (Akbulut-Yuksela and Kugler 2016). Characteristics of the father were not considered. Nevertheless, persistence of intergenerational effects were reduced the longer immigrants remained in the U.S., i.e., as they became more acculturated to the American way of life including diet, habits of regular physical activity and perhaps risk taking behaviors. The preceding trend is sometimes labeled the “immigrant epidemiological paradox” (Baker et al. 2015).

Limitations and Overview

In addition to limited numbers, the samples in the present study included older adults who were born and reared under very different conditions in Texas and Upper Silesia. The Texas sample is comprised of descendants of migrants to Texas about five-six generations ago; however, information on admixture with other ethnic groups in Texas and on the health status of the migrant families over time is not available. Nevertheless, male descendants of immigrants to Texas in 1929–1930 (Rosiński 1934a) and in 2013–2014 did not differ in mean heights, while female descendants of immigrants to Texas in 2013–2014 were, on average, taller than descendants of immigrants to Texas in 1929–1930.

Male descendants of Silesian immigrants to Texas were, on average, taller

and heavier with a higher BMI and estimated FFM than residents in Upper Silesia. Female descendants of Silesian immigrants to Texas were taller, but residents in Upper Silesia had a higher BMI and estimated fatness. All residents in Silesia and the majority of descendants of Silesian migrants were classified as overweight or obese.

Differences in hemodynamic and respiratory functions and responses to a 6-minute walk were inconsistent between the samples, while none of the fitness variables differed significantly between the descendants of Silesian migrants and residents in Upper Silesia in both sexes. Although residents Upper Silesian men and women were more physically active than Silesians in Texas, the overwhelming majority of men and women in both samples (>80%) scored below the criterion-reference standards for the maintenance of physical independence in the 6-minute walk.

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The Authors' contribution

KR-P design the study, write the first and final draft; MK, AS, TO-S took part in designing the study, wrote the first and last draft; RM and SK did statistical analysis, interpretation of results, wrote the first and last draft; ZI was a leader of the study, wrote the first and last draft.

Conflict of interest

The authors declare that there is no conflict of interest.

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