Family Health Strategy, Primary Health Care, and Social Inequalities in Mortality Among Older Adults in Bagé, Southern Brazil

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See also Miles, p. 762, and Galea and Vaughan, p. 787.

Objectives. To investigate the role of the Family Health Strategy (FHS) in reducing social inequalities in mortality over a 9-year follow-up period.

Methods. We carried out a population-based cohort study of individuals aged 60 years and older from the city of Bagé, Brazil. Of 1593 participants at baseline (2008), 1314 (82.5%) were included in this 9-year follow-up (2017). We assessed type of primary health care (PHC) coverage and other variables at baseline. In 2017, we ascertained 579 deaths through mortality registers. Hazard ratios and their 95% confidence intervals modeled time to death estimated by Cox regression. We also tested the effect modification between PHC and wealth.

Results. The FHS had a protective effect on mortality among individuals aged 60 to 64 years, a result not found among those not covered by the FHS. Interaction analysis showed that the FHS modified the effect of wealth on mortality. The FHS protected the poorest from all-cause mortality (hazard ratio [HR] = 0.59; 95% confidence interval [CI] = 0.36, 0.96) and avoidable mortality (HR = 0.46; 95% CI = 0.25, 0.85).

Conclusions. FHS coverage reduced social inequalities in mortality among older adults. Our findings highlight the need to guarantee universal health coverage in Brazil by expanding and strengthening the FHS to promote health equity. (*Am J Public Health*. 2021;111:927–936. https://doi.org/10.2105/AJPH.2020.306146)

Socioeconomic inequalities in mortality are a major public health issue because the associated burden is on a grand scale[1] and persists at older ages.[1–3] Monitoring the magnitude of socioeconomic inequalities in mortality among older adults has become even more important because of worldwide population aging.[2] Such inequalities indicate the need for improvements in life expectancy among lower socioeconomic groups[2] as well as policies that address both social and medical determinants of health.[4,5]

Policies toward universal public health systems[5] framed by the values and principles of primary health care (PHC) represent the main strategy to achieve the World Health Organization's stated goal of health for all.[6] PHC was introduced in the Brazilian public health system during the 1980s and implemented after the creation of the Unified Health System (Sistema Único de Saúde [SUS]), which made considerable progress toward delivering universal and comprehensive health care during the last 30 years.[7] During the 1990s, the Family Health Strategy (FHS) was developed to reorganize and restructure the health system, aiming to strengthen primary care.[7–9]

The FHS has multidisciplinary teams, including community health workers, that are responsible for meeting the heath care needs of approximately 1000 households in a defined geographical area.[10,11] By contrast, traditional primary health care (TPHC) teams do not have a fixed structure; contain more medical professionals, sometimes including specialists such as pediatricians, obstetricians, and gynecologists; do not serve

a defined number of families or geographical area; and do not usually include community health workers.[9] TPHC focuses on specific diseases, dispenses curative care, and acts on emerging demands, with little ability to solve health problems related to family and social issues[9]; on the other hand, the FHS delivers a range of services, including acute care, comprehensive and longitudinal health care, risk factor management, referral, prevention, health promotion, and health education, bringing health care closer to where people live and work.[9,11] Under the FHS model, the household is part of the care environment and the team is expected to be proactive, identifying the social and health problems and the most vulnerable members of the population.[9,11] In the FHS, professionals also deliver home health care to those who are unable to reach health services—for example, those who are bedridden or have other serious health conditions.[9] The transformation of the care model in Brazilian PHC is not a discretionary change in which the Ministry of Health implements a new policy changing the organization of PHC throughout the country, but gradual, where the municipal governments are responsible for FHS service provision and population coverage, with funding primarily from the federal government.

Most Brazilian municipalities have adopted the FHS (often by replacing TPHC),[9] and it has become the largest community-based PHC program in the world.[11] The number of family health teams increased from 2054 in 1998[12] to 43 508 in 2019.[13] The proportion of older adults registered by the FHS in this period increased from 4.4% (620 000) to 64.2% (18 million).[13] The priority was to implement the FHS first in the poorest and medically underserved areas, guided by the National Policy on Primary Care, to promote universal access and reduce health inequalities.[8,9] In 2013, the FHS covered 53.4% of all Brazilian households, with higher coverage in rural (70.9%) than in urban (50.6%) areas, and in the poorest regions and states.[14]

Expansion of the FHS has been associated with improvements in general population health indicators,[15] but there is a scarcity of studies about the impact of this strategy on older adults. Evidence shows reductions in mortality from cardiovascular disease[16] (the main cause of death in Brazil among those aged 60 years or older), reduction in hospitalization rates from ambulatory care–sensitive conditions,[17] improvement in quality of health care as a result of enhanced continuity of care,[18] and increased access and utilization of health services, including home health care.[9] These findings suggest that the FHS is a potential vehicle for addressing social inequalities in health.[8,9,15]

Worldwide, however, there is a paucity of knowledge on how PHC may help to reduce the impact of social inequalities on health. Two Brazilian[19,20] and 2 North American studies[21,22] investigated the impact of PHC on reducing the effect of social inequalities by race and socioeconomic groups; 3 North American studies focused on income, education, and other sociodemographic covariates[23–25]; and 1 North American study considered urban and nonurban health inequalities.[26] We found no studies on the relationship between primary care and social inequalities in mortality among older Brazilian adults.

In this context, our aim was to investigate the role of the FHS in reducing social inequalities in all-cause and avoidable mortality among older adults in Bagé, Rio Grande do Sul, Brazil. In addition, we assessed whether PHC coverage type modified the effect of wealth on mortality. There is a higher mortality risk among those living in lower social conditions,[1,3,4] who make up the majority in the area covered by the FHS.[9] However, we expected no difference in mortality by PHC coverage type, given that the FHS should be able to minimize the impact of social inequalities by offering access to health care among the poorest.

METHODS

The Bagé Longitudinal Study of Ageing (SIGa-Bagé) is a population-based cohort study of people aged 60 years and older in Bagé city, in the state of Rio Grande do Sul, Brazil. It is the first longitudinal aging study in Brazil to assess the impact of PHC services on social inequities in health and mortality. In 2008, 1593 participants recruited from private households took part of the baseline interview. The sample was representative of the urban area of the city, which was covered by PHC services.[9] Its sampling design and data collection methods are described elsewhere.[9]

Surviving cohort members had face-to-face interviews after 9 years of follow-up. Of the 1593 participants at baseline, complete data were available for 1314 participants at follow-up in 2016 and 2017 (735 reinterviewed + 579 confirmed deaths). Among the 735 participants, 54% were covered by the FHS and 46% by the TPHC.

Mortality Data Source

We defined type of PHC coverage (FHS or traditional) at baseline for the whole cohort, and assessed vital status in the follow-up.[9] We ascertained deaths

through the Mortality Information System. We obtained death certificates for 91% of the participants (579 cases: FHS = 53.5% and TPHC = 46.5%) who were reported to have died through August 2017 (638 cases). We obtained cause of death for 564 participants, using the *International Classification of Diseases, 10th Revision* (*ICD-10*). Additionally, we classified deaths into nonavoidable and potentially avoidable causes, using a previously developed list of avoidable mortality conditions from Brazil.[27]

Primary Health Care Coverage Type

At baseline (2008), Bagé had 20 PHC service centers; 15 of them had implemented the FHS and 5 had followed the TPHC model. Half of the city's population (51%) was covered by the FHS, offering multidisciplinary team- and community-based family health care in the city's periphery, which comprises the most deprived areas of the city. TPHC services covered populations from the central and less deprived area of the city and did not incorporate multidisciplinary teams, home visits, or other community-based services.[9] If one imagines a circle, in the baseline study, the richest—covered by TPHC—lived in the city's central portion and the poorest—covered by the FHS—in the city's periphery. Assuming that we had a probabilistic distribution of the sample in the city,[9] 852 respondents (54%) lived in areas covered by the FHS, making our study a type of natural experiment.[28]

Covariates

Covariates were obtained in 2008 (Table 1) and included age, gender, marital status (partner vs no partner), multigenerational household, and

TABLE 1— Selected Baseline Characteristics of Participants by Type of Primary Health Care Service: The SIGa-Bagé Cohort Study, Bagé, Rio Grande do Sul, Brazil, 2008–2017

Variables	Total (n = 1314), No. (%)	TPHC (n = 605), No. (%)	FHS (n = 709), No. (%)	*P*
Marital status				.38
Partner	658 (50.08)	295 (48.76)	363 (51.20)	
No partner	656 (49.92)	310 (51.24)	346 (48.80)	
Race/ethnicity				< .001
White	1064 (80.97)	521 (86.12)	543 (76.59)	
Black, Brown, Asian, Indigenous	250 (19.03)	84 (13.88)	166 (23.41)	
Multigenerational household				.91
No	613 (46.65)	281 (46.45)	332 (46.83)	
Yes	701 (53.35)	324 (53.55)	377 (53.17)	
Per capita income, US$				.15
≥ 129.7	1110 (84.67)	520 (86.24)	590 (83.33)	
< 129.7	201 (15.33)	83 (13.76)	118 (16.67)	
Years of schooling				< .001
≥ 8	270 (20.55)	183 (30.25)	87 (12.27)	
4–7	404 (30.75)	194 (32.07)	210 (29.62)	
< 4	640 (48.71)	228 (37.69)	412 (58.11)	
Wealth				< .001
AB (richest)	340 (26.07)	206 (34.22)	134 (19.09)	
C	506 (38.80)	246 (40.86)	260 (37.04)	
DE (poorest)	458 (35.12)	150 (24.92)	308 (43.87)	
Current smoker				.004
No	1110 (84.47)	530 (87.60)	580 (81.81)	
Yes	204 (15.53)	75 (12.40)	129 (18.19)	
Sedentary				.008
No	766 (58.30)	329 (54.38)	437 (61.64)	
Yes	548 (41.70)	276 (45.62)	272 (38.36)	
Hypertension				.61
No	583 (44.37)	273 (45.12)	310 (43.72)	
Yes	731 (55.63)	332 (54.88)	399 (56.28)	
Diabetes				.039
No	1111 (84.55)	525 (86.78)	586 (82.65)	
Yes	203 (15.45)	80 (13.22)	123 (17.35)	
Depression				.026
No	1014 (81.64)	483 (84.29)	531 (79.37)	
Yes	228 (18.36)	90 (15.71)	138 (20.63)	
Disability (ADL + IADL)				.001
No	827 (63.03)	409 (67.60)	418 (59.12)	
Yes	485 (36.97)	196 (32.40)	289 (40.88)	

Continued

TABLE 1— Continued

Variables	Total (n = 1314), No. (%)	TPHC (n = 605), No. (%)	FHS (n = 709), No. (%)	P
Self-perception of health				.51
Good/very good	726 (57.26)	339 (58.25)	387 (56.41)	
Regular/bad/worse	542 (42.74)	243 (41.75)	299 (43.59)	
Gender				.07
Female	815 (62.02)	391 (64.63)	424 (59.80)	
Male	499 (37.98)	214 (35.37)	285 (40.20)	
Age, y				.011
60–64	312 (23.74)	124 (20.50)	188 (26.52)	
65–74	567 (43.15)	260 (42.98)	307 (43.30)	
≥ 75	435 (33.11)	221 (36.53)	214 (30.18)	
Private health insurance				< .001
No	864 (66.11)	343 (56.88)	521 (74.00)	
Yes	443 (33.89)	260 (43.12)	183 (26.00)	
Hospitalization[a]				.73
No	1069 (81.42)	495 (81.82)	574 (81.07)	
Yes	244 (18.58)	110 (18.18)	143 (18.93)	
Visited a doctor[b]				.24
No	559 (45.62)	265 (43.87)	334 (47.11)	
Yes	714 (54.38)	339 (56.13)	375 (52.89)	
Home health care				< .001
No	1218 (92.84)	582 (96.20)	636 (89.96)	
Yes	94 (7.16)	23 (3.80)	71 (10.04)	
PHC coverage type				
TPHC	605 (46.04)	...	...	...	...	...
FHS	709 (53.96)	...	...	...	...	...

Note. ADL = activities of daily living; FHS = Family Health Strategy; IADL = instrumental activities of daily living; PHC = primary health care; TPHC = traditional primary health care.

[a]Hospitalization during the last y before the interview.
[b]Visited a doctor during the last 3 m before the interview.

self-reported ethnicity (White, Brown, Black, Asian, or Indigenous). Because of the very small numbers, we merged the deaths of Black, Brown, Asian, and Indigenous individuals into 1 group. For stratification by monthly per capita income, we followed the Brazilian government guidelines that define a low-income family as one with a per capita monthly income up to half of the federal minimum wage. We considered the participant to be living in a low-income family when per capita monthly income was lower than US $129.7 at baseline (exchange rate, US $1 = 1.60 Brazilian reals).

We categorized schooling into 3 groups (< 4, 4–7, and ≥ 8 years). We assessed wealth using the Brazilian Economic Classification Criteria scale, which considers information on household furniture(s), car(s), housekeeper(s), and the highest educational attainment of the head of the household. We grouped participants into 5 categories (from A [the richest] to E [the poorest]). For statistical purposes, we merged the categories as follows: D and E = poorest, C = middle, and A and B = richest.

Health behaviors included were current smoking (no, yes) and physical inactivity (no, yes), defined as when a participant did not walk or perform any moderate or vigorous-intensity activities for at least 10 minutes at least once a week. Health conditions included were self-reported doctor-diagnosed hypertension and diabetes (i.e., "Did a doctor ever tell you that you had ...?"); depression (no, yes) as measured by the abbreviated instrument of the Geriatric Depression Scale; disability based on the basic activities of daily living and instrumental activities of daily living as measured by the Katz and Lawton scales[29]; and self-rated health status, which we collected in 5 categories and then merged into 2 categories (good or very good vs regular, bad, or worse).[9]

For health services indicators, we considered having private health insurance (no, yes), home health care from a health care professional during the last 3 months (no, yes), hospitalization during the last year before the interview at baseline (no, yes), physician visits during the last 3 months before the interview at baseline (no, yes), and, finally, PHC models (TPHC, FHS).

Statistical Analyses

First, we described all variables and compared proportions using a χ^2 test. Second, we used Cox proportional hazards models adjusted by gender, age, and wealth to examine the size of the risk by age group in both PHC types and the risk by PHC types in each age group. The time modeled was the period each participant was in the study, calculated as the difference in years (continuous variable) between date of birth and date of death or the study's end date.

TABLE 2— Adjusted Cox Regression of All-Cause and Avoidable Mortality Risk Among Older Adults: The SIGa-Bagé Cohort Study, Bagé, Brazil, 2008–2017

Variables	All-Cause Mortality (n = 579), HR (95% CI)	Avoidable Mortality (n = 380), HR (95% CI)
Level 1		
Marital status (Ref: partnered)	1.33 (1.13, 1.57)	1.44 (1.18, 1.77)
Race/ethnicity (Ref: White)	1.04 (0.84, 1.28)	1.01 (0.77, 1.31)
Multigenerational household (Ref: yes)	1.01 (0.84, 1.19)	1.01 (0.81, 1.25)
Per capita income (Ref: ≥ 129.7)	1.27 (1.03, 1.58)	1.43 (1.11, 1.84)
Years of schooling (Ref: ≥ 8)[a]	1	1
4–7	1.18 (0.92, 1.51)	1.22 (0.89, 1.66)
< 4	1.28 (1.02, 1.60)	1.37 (1.03, 1.82)
Wealth (Ref: richest)[a]	1	1
Middle	1.17 (0.91, 1.49)	1.11 (0.81, 1.54)
Poorest	1.11 (0.83, 1.47)	1.07 (0.74, 1.53)
Level 2		
Smoking (Ref: no)	1.11 (0.89, 1.39)	1.16 (0.88, 1.52)
Inactivity (Ref: no)	2.11 (1.79, 2.49)	1.92 (1.57, 2.35)
Level 3		
Diabetes (Ref: no)	1.03 (0.81, 1.31)	1.16 (0.87, 1.54)
Hypertension (Ref: no)	0.91 (0.77, 1.09)	0.89 (0.71, 1.10)
Depression (Ref: no)	1.13 (0.91, 1.41)	1.14 (0.87, 1.51)
Disability (Ref: no)	1.69 (1.42, 2.03)	1.71 (1.37, 2.13)
SPH (Ref: good/very good)	1.36 (1.14, 1.62)	1.30 (1.04, 1.61)
Level 4		
Age, y (Ref: 60–64)[a]	1	1
65–74	1.39 (1.07, 1.78)	1.38 (1.01, 1.88)
≥ 75	2.61 (2.02, 3.39)	2.37 (1.73, 3.27)
Gender (Ref: male)	0.60 (0.49, 0.73)	0.60 (0.47, 0.76)
Level 5		
PHC type (Ref: TPHC)	1.04 (0.86, 1.26)	1.19 (0.94, 1.52)
Home health care (Ref: no)	1.61 (1.16, 2.22)	1.47 (0.98, 2.21)
Private health insurance (Ref. no)	0.91 (0.75, 1.11)	0.84 (0.65, 1.08)
Hospitalization (Ref. no)	1.38 (1.11, 1.71)	1.38 (1.06, 1.81)
Visited doctor (Ref: no)	0.86 (0.72, 1.03)	0.80 (0.64, 1.01)

Continued

Third, we used multivariate analysis by Cox proportional hazards models to verify associations between PHC coverage type and all-cause and avoidable mortality, while adjusting for covariates. We summarized results using hazard ratios and their respective 95% confidence intervals. We built a conceptual hierarchical framework of risk factors for mortality in older adults. This is an approach to reduce the analysis matrix in order to improve the power of analysis of distal determinants of health.[30] In our hierarchical model, for each level of adjustment, we retained all variables with a *P* value of .20 or less in the subsequent levels. Level 1 included socioeconomic risk factors. In level 2, we added health behaviors to the socioeconomic variables selected from level 1. In level 3, we added health condition variables. In level 4, we added demographic variables. In level 5, we added health services variables to those selected in levels 1, 2, 3, and 4. We used backward stepwise elimination by levels (1 variable at a time) to build the final model. In the final step, we tested the interaction between PHC type and wealth along with both variables separately. The variables kept in the final adjustment model are

TABLE 2— Continued

Variables	All-Cause Mortality (n = 579), HR (95% CI)	Avoidable Mortality (n = 380), HR (95% CI)
	Final adjustment model[b]	
PHC type (Ref: TPHC)	1.77 (1.19, 2.63)	2.54 (1.37, 3.57)
Wealth (Ref: richest)[a]	1	1
Middle	2.07 (1.46, 2.93)	2.21 (1.37, 3.57)
Poorest	1.75 (1.16, 2.61)	1.75 (1.00, 3.06)
PHC type##wealth (Ref: richest)		
FHS#middle[c]	0.44 (0.27, 0.71)	0.31 (0.17, 0.58)
FHS#poorest[c]	0.59 (0.36, 0.96)	0.46 (0.25, 0.85)

Note. CI = confidence interval; FHS = Family Health Strategy; HR = hazard ratio; PHC = primary health care; SPH = self perception of health; TPHC = traditional primary health care. Level 1 = adjusted to socioeconomic conditions: marital status, skin color, multigenerational household, per capita income, school and wealth. Level 2: adjusted to selected variables from level 1 + health behaviors: smoking and physical inactivity. Level 3: adjusted to selected variables from levels 1 and 2 + health conditions: hypertension, diabetes, depression, disabilities, and SPH. Level 4: adjusted to selected variables from levels 1, 2, and 3 + demographic conditions: gender and age. Level 5: adjusted to selected variables from levels 1, 2, 3, and 4 + health service indicators: PHC type, home health care, private health insurance, hospitalization, and visited a doctor.

[a]Testparm (Wald test).
[b]Final adjustment model for all-cause mortality included the following: marital status, per capita income, school, inactivity, disability, SPH, age, gender, home health care, visited a doctor, hospitalization, and interaction between PHC type and wealth. Final adjustment model for avoidable mortality included the following: marital status, per capita income, school, inactivity, disability, SPH, age, gender, PHC type, home health care, private health insurance, visited a doctor, hospitalization, and interaction between PHC type and wealth.
[c]Reference level is richest in FHS. Test of proportional-hazards assumption with a robust variance-covariance matrix used the following: all-cause mortality—level 2: inactivity $P = .003$, and level 5: home health care $P = .022$; avoidable-cause mortality—level 2: inactivity $P = .001$, and level 4: gender $P = .011$.

described in the footnote to Table 2. Variables with a P value of .05 or less were considered significant.

We used Schoenfeld residuals to test the proportional-hazards assumption with a robust variance–covariance matrix in each level. We did not find multicollinearity between demographic and socioeconomic variables included in the model (variance inflation factor ≤ 1.5). We applied likelihood ratio tests to compare nested models, and the presence of the interaction term improved model fit. In the case of significant interactions, we decided to explain the interaction rather than stratify in subgroups, for statistical efficiency (low number of observations). We used Stata 14.0 (Stata Corp, College Station, TX) for the analysis.

RESULTS

Of the 1593 eligible participants at baseline, information was available for 1314. There was no difference in the proportion of included and excluded participants by PHC type ($P = .428$; Table A, available as a supplement to the online version of this article at http://www.ajph.org). Those included in our analyses were slightly older than those excluded (71.6 years [SD = 8.4] vs 69.2 years [SD = 7.1]; $P < .001$).

Table 1 shows selected baseline characteristics of participants by PHC type. The mean age was 71.6 years (SD = 8.4), but participants in TPHC were slightly older than those in the FHS (72.3 [SD = 8.5] vs 71.0 [SD = 8.3]; $P = .007$). Compared with participants in TPHC, participants in the FHS were more similar in terms of proportion of men and women, marital status, multigenerational household, monthly per capita income, hypertension, self-perception of health, hospitalization, and physician visits. Compared with participants in TPHC, however, those in the FHS were more likely to be Black, Brown, Asian, and Indigenous (13.9% vs 23.4%, respectively); to have lower levels of schooling (37.7% vs 58.1%); to be in wealth group DE (poorest; 24.9% vs 43.9%); to be current smokers (12.4% vs 18.2%); and to have diabetes (13.2% vs 17.3%), depression (15.7% vs 20.6%), or disability (32.4% vs 40.9%). Compared with participants in TPHC, FHS participants were less likely to be aged 75 years or older (36.5% vs 30.2%, respectively), to have private health insurance (43.1% vs 26.0%), or to be physically inactive (42.6% vs 38.4%; Table 1).

There were 579 deaths confirmed by the Mortality Information System over the follow-up period (mean duration = 6.4 years; SD = 2.6). The overall unadjusted mortality rate was 67.6 (62.3–73.3) deaths per 1000 person-years: 69.0 (61.2–77.7) in TPHC services and 66.3 (59.4–74.2) in the FHS.

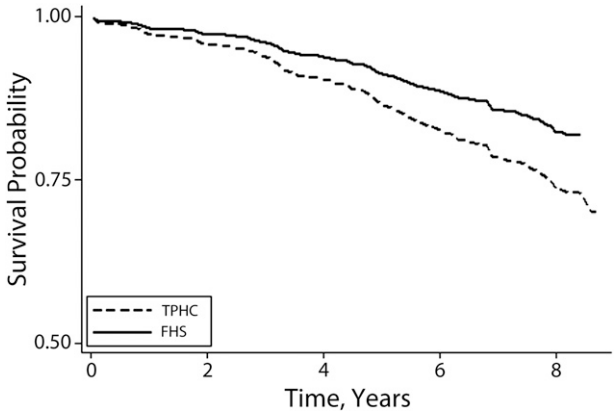

FIGURE 1— All-Cause Mortality by Primary Health Care Coverage in Age Group 60–64 Years, Adjusted for Gender, Age, and Wealth: The SIGa-Bagé Cohort Study, Bagé, Rio Grande do Sul, Brazil, 2008–2017

Note. FHS = Family Health Strategy; TPHC = traditional primary health care. The sample size was 309 observations and 83 failures.

Regarding all-cause mortality risk by age group in TPHC and the FHS, adjusted for gender and wealth, there was a difference between the youngest and the middle age group in the FHS (60–64 years: hazard ratio [HR] = 0.24; 95% confidence interval [CI] = 0.17, 0.33; 65–74 years: HR = 0.40; 95% CI = 0.31, 0.51; ≥ 75 years = reference) that was not found in TPHC (60–64 years: HR = 0.36; 95% CI = 0.25, 0.51; 65–74 years: HR = 0.38; 95% CI = 0.29, 0.50; ≥ 75 years = reference). Figure 1 shows all-cause mortality risk by PHC type among those aged 60 to 64 years, adjusted for gender, age, and wealth; it suggests a lower mortality risk among those in the FHS (HR = 0.64; 95% CI = 0.40, 1.01) compared with TPHC, attaining marginal significance ($P = .056$). There was no difference in mortality risk by PHC type among those aged 65 to 74 years ($P = .523$) and those 75 years or older ($P = .370$; Figures A and B, available as a supplement to the online version of this article at http://www.ajph.org).

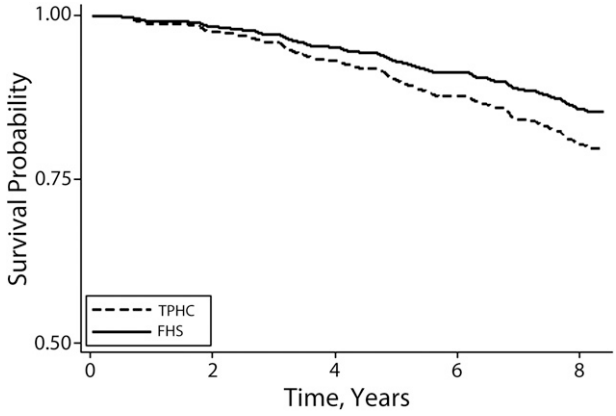

FIGURE 2— Avoidable Mortality by Primary Health Care Coverage in Age Group 60–64 Years, Adjusted for Gender, Age, and Wealth: The SIGa-Bagé Cohort Study, Bagé, Rio Grande do Sul, Brazil, 2008–2017

Note. FHS = Family Health Strategy; TPHC = traditional primary health care. The sample size was 309 observations and 55 failures.

Avoidable mortality corresponded to 67.4% of the total deaths, and there was no difference in the proportion by PHC type (TPHC = 62.8% and FHS = 71.3%; $P = .097$). Among the avoidable causes, 87.1% were related to noncommunicable diseases, 11.1% to infectious causes, and 1.8% to external causes. There were no avoidable causes of death related to immune preventive actions. Poorly defined causes comprised 2.5%. Figure 2 shows avoidable mortality risk by PHC type among those aged 60 to 64 years. No difference was found (FHS: HR = 0.70; 95% CI = 0.39, 1.26; $P = .235$), with similar results among those aged 65 to 74 years ($P = .247$) and those 75 years or older ($P = .087$; Figures C and D, available as a supplement to the online version of this article at http://www.ajph.org).

In the first level of the multivariable-adjusted regression model (Table 2), wealth was not associated with mortality. In the final adjusted model, wealth was associated with all-cause and avoidable mortality, with a higher risk among the middle group and the poorest. Interaction analyses revealed that the effect of wealth on mortality was modified by PHC type (likelihood-ratio test $P = .004$). In the FHS, the middle and the poorest wealth group had lower risk of all-cause mortality (middle: HR = 0.44; 95% CI = 0.27, 0.71; poorest: HR = 0.59; 95% CI = 0.36, 0.96) and avoidable mortality (middle: HR = 0.31; 95% CI = 0.17, 0.58; poorest: HR = 0.46; 95% CI = 0.25, 0.85), compared with the richest (Table 2).

DISCUSSION

To our knowledge, this is the first study to analyze the role of the FHS in reducing social inequalities in mortality among older Brazilian adults. As expected, social vulnerability is higher in those living

in FHS areas, and consequently a higher proportion of health problems were observed in these areas. However, the FHS was negatively associated with all-cause mortality in the youngest age group, a result not found among those covered by TPHC. Moreover, PHC type significantly modified the effect of wealth on all-cause and avoidable mortality, with the FHS having a protective role among the middle and lowest wealth groups.

A middle-income country like Brazil is the perfect setting for evaluating the relationship between PHC and health inequalities.[8,15,19] Brazil has some of the world's highest income (Gini coefficient = 0.53 in 2017)[31] and health inequalities[3,32] along with one of world's fastest population aging rates.[5] Despite the need of more studies that address social inequalities in mortality among older adults in low- and middle-income countries,[3] the effect of social determinants on health is well-known.[4,5] What is not yet clear is the impact or effectiveness of health programs and policies, such as those based on PHC principles, in addressing the social determinants of health and reducing health inequalities.

The characteristics of the FHS enable the health team to deliver health actions throughout the life course for those with social and health vulnerabilities, reducing mortality in the youngest age group. The youngest elderly have a higher probability of being in the early stages of disease development, mainly noncommunicable diseases, which facilitates treatment, recovery, prevention of complications, and, when offered, health service access and quality, home health care, and health promotion and education—a role of the FHS. Intervening in the disease pathway is a way to reduce hospitalizations and avoid premature mortality.

The higher proportion of avoidable mortality corroborates evidence from other Brazilian studies.[33] We found no other study dealing specifically with the impact of PHC types on avoidable mortality due to interventions at the SUS.[27] There are, however, studies on hospitalizations from ambulatory care–sensitive conditions that suggest that the FHS is more equitable than TPHC.[34]

Interaction analysis highlighted that PHC coverage type modified the effect of wealth on mortality. Survival probabilities were higher among the middle and the lower wealth groups compared with the richest in FHS areas. This study showed a greater effect of the FHS on social inequalities in all-cause and avoidable mortality than we expected, confirming the effectiveness of the FHS in reducing social inequalities. A recent study showed that FHS utilization in urban poor Brazilian populations was associated with lower mortality risk, with greater reductions among more deprived racial/ethnic and socioeconomic groups.[20] Relevant characteristics of the FHS that differ from those of TPHC and that could explain our findings include the presence of multidisciplinary teams that include community health workers, better access and quality, home health care, monitoring and follow-up care delivered in the neighborhood and individuals' homes, and targeting actions toward the family and individuals in the community.

The FHS alone cannot protect one from exposure to social and lifestyle risk factors. However, it is able to reduce health inequalities by addressing one's health needs. In part, these results could be related to social policies implemented during the last 2 decades (e.g., the Bolsa Família Program, whose conditional cash transfers benefit low-income families).[7] Evidence from Brazil shows that reduction in infant mortality was associated with both greater coverage by the FHS and the Bolsa Família Program, demonstrating the importance of combining interventions for the most vulnerable populations.[35]

The superiority of the FHS over TPHC has become a national and international consensus.[15] However, these gains are fragile. Brazil is undergoing a sociopolitical and economic transition, accompanied by austerity policies, changes in the financing of health programs, and reorganization of successful health programs, which is likely to adversely affect the SUS and PHC, worsening inequalities.[7] These changes and their impact on health must be monitored.

Brazilian experts in PHC services propose the universalization of the FHS, political commitment, sufficient public financing, and efficient allocation of resources to increase the superiority of the FHS[7,8,15] in facing increased health and social demands among older adults, the users most affected by multimorbidity and mental health problems.[15]

Strengths and Limitations

This study has strengths and limitations. Its strengths are its long follow-up period and high response rate. Furthermore, the data collected at baseline were obtained by trained professionals using standard techniques with quality control checks. The findings are from a city of more than 100 000 inhabitants in the south of Brazil, and despite the low number of observations, we had the power to find statistical differences. Among the limitations, both the PHC coverage type and the other covariates were assessed only at baseline; therefore, we did not capture any change in these variables over time. The present study also did not allow us to perform analyses for specific causes of death.

Because the information on doctor-diagnosed conditions was self-reported, there is a risk of underestimating the prevalence of comorbidities. Another limitation of this study is that it considered all older ages, whereas the classification of avoidable mortality due to interventions at the SUS was intended for the population aged 5 to 69 years.[27]

Public Health Implications

The FHS is a powerful tool for reducing social inequalities in all-cause and avoidable mortality among older adults. It is an effective approach to organizing PHC and may accelerate the achievement of the goal of health for all. The expansion of FHS coverage and the strengthening of health policies based on PHC principles should be considered. However, the expansion of the FHS should not be only about the number of health teams but also about effective health actions, putting into practice Brazil's policy on health promotion. Bagé city has achieved equity in health through political stability and sustained health investment, a model that provides important lessons for other cities around the world. AJPH

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CONTRIBUTORS

M. Kessler, E. Thumé, L. Soares Wachs, and P. Moraes Volz collected the data. M. Kessler, J. Macinko, and F. Borges Nedel analyzed the data. M. Kessler, E. Thumé, L. A. Facchini, F. Borges Nedel, and C. de Oliveira interpreted the data. M. Kessler, L. Soares Wachs, and P. Moraes Volz wrote the first draft of the article, and E. Thumé, M. Marmot, J. Macinko, L. A. Facchini, F. Borges Nedel, and C. de Oliveira revised the article. All authors read and approved the final article.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

The SIGa-Bagé cohort study was approved by the Ethics Board of the Federal University of Pelotas, Brazil (protocol no. 015/2008 and 678.664/2014). Participants gave full informed consent.

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