

# Status inconsistency and mortality in the immigrant population in the Turin and the Emilian Longitudinal Studies

## Inconsistenza di status e mortalità nella popolazione immigrata negli Studi Longitudinali Torinese ed Emiliano

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### ABSTRACT

**OBJECTIVES:** to compare the educational gradient in mortality between Italians and immigrants and to assess the hypothesis of status inconsistency in the immigrant population, evaluating the relationship between educational qualification and occupational class.

**DESIGN:** multicentre longitudinal study.

**SETTING AND PARTICIPANTS:** subjects aged 30-64 years, resident in Turin, Bologna, Modena, or Reggio Emilia who took part in the 2011 Census and followed up until 31.12.2018.

**MAIN OUTCOME MEASURES:** all-cause mortality by educational qualification and occupational class was compared between Italians and immigrants from High Migratory Pressure countries; analyses were carried out using mortality rate ratios (MRR) and relative index of inequality (RII), applying Poisson models, adjusted for city, calendar period, age, and macroareas of origin, stratified by gender.

**RESULTS:** occupational class among immigrants is evenly distributed across educational qualifications. Compared with Italians, immigrant men and women had a weaker and non-significant inverse educational gradient in mortality, which did not change substantially after the adjustment for occupational class.

**CONCLUSIONS:** the results support the status inconsistency hypothesis, which may be partly responsible for the observed flattening of the educational gradients. The macroarea of origin appears to be a key determinant of mortality inequalities. Therefore, the use of educational qualification in exploring health inequalities among immigrants should be always complemented with other indicators of socioeconomic position and migratory history.

**Keywords:** immigrants, health inequalities, education, socioeconomic, Italy

### RIASSUNTO

**OBIETTIVI:** confrontare il gradiente di istruzione nella mortalità prematura tra italiani e immigrati e valutare l'ipotesi dell'inconsistenza di status nella popolazione immigrata, analizzando la relazione tra titolo di studio e classe occupazionale.

**DISEGNO:** studio multicentrico longitudinale

**SETTING E PARTECIPANTI:** soggetti con età 30-64 anni, censiti nel 2011 residenti a Torino, Bologna, Modena o Reggio Emilia e con follow-up fino al 31.12.2018.

### WHAT IS ALREADY KNOWN

- Many studies confirm the advantage in terms of mortality of immigrants compared to the native population.
- Little is known about the relationship between immigrant status and the different components of the individual socioeconomic position.

### WHAT THIS PAPER ADDS

- Immigrants have a less steep educational gradient than Italians.
- Immigrants are mainly employed in manual works, with no substantial differences by educational qualification.
- Status inconsistency may be partly responsible for the observed flattening of the educational gradients in mortality.

**PRINCIPALI MISURE DI OUTCOME:** la mortalità generale per titolo di studio e classe occupazionale degli italiani è stata confrontata con quella degli immigrati provenienti da Paesi a forte pressione migratoria, utilizzando i *mortality rate ratio* (MRR) e i *relative index of inequality* (RII), stimati attraverso modelli di Poisson, aggiustati per città, periodo di calendario, età e macroarea, e stratificati per genere.

**RISULTATI:** a differenza di quanto accade per gli italiani, tra gli immigrati le diverse categorie della classe occupazionale sono distribuite in modo omogeneo per titolo di studio. Rispetto agli italiani, i maschi e le femmine immigrati hanno un gradiente inverso più debole e non significativo nella mortalità per istruzione, che non cambia sostanzialmente dopo l'aggiustamento per la classe occupazionale.

**CONCLUSIONI:** i risultati supportano l'ipotesi dell'inconsistenza di status, che contribuisce all'appiattimento del gradiente del titolo di studio tra gli immigrati. La macroarea di origine sembra essere un fattore determinante per le disuguaglianze di mortalità. L'uso del titolo di studio per esplorare le disuguaglianze di salute tra gli immigrati dovrebbe essere sempre integrato con altri indicatori di posizione socioeconomica e di storia migratoria.

**Parole chiave:** immigrati, disuguaglianze di salute, istruzione, livello socioeconomico, Italia

## INTRODUCTION

The literature is rich in studies on the health of immigrant populations, especially in countries that have historically been the destination of large migratory flows. Research on the mechanisms of the association between migration and health involves both the individual's migratory history (e.g., country of origin and arrival, reasons for migration, age on arrival, and length of stay in the host country)<sup>1</sup> and the social determinants of health, related to the characteristics of the living and working environment, or more directly linked to the individuals and their lifestyles.<sup>2</sup>

Early works on the subject have often observed a 'healthy migrant effect', according to which people who leave their country, usually in search of a better job, are on average healthier than both their peers who do not emigrate and those in the host country.<sup>3,4</sup> However, subsequent studies have repeatedly reported that, as the length of stay in the host country increases, the health advantage of migrants diminishes. This may be explained by the poor living and working conditions that immigrants – similarly to the lower social strata of the native population – experience in the host country, whose negative effects on health have been extensively documented in Europe for years.<sup>5,6</sup> This accumulation of disadvantages contributes to the so-called 'exhausted migrant effect',<sup>7</sup> i.e., differential health transition patterns over the life course between immigrants and natives.<sup>8,9</sup> This also leads to another phenomenon called 'salmon effect', according to which older immigrants in poor health (and likely in poor socioeconomic conditions) might return to their home countries to face illness and possible death together with their families.<sup>10,11</sup> The impact of the socioeconomic status of immigrants is, therefore, increasingly important<sup>12-15</sup> and a more integrated view of the interrelationships between determinants linked to the migratory process and social determinants is needed.<sup>16</sup>

In Italy, the phenomenon of immigration is relatively recent; nonetheless, substantial scientific evidence on the health of immigrants from Highly Migratory Pressure countries (HMPC) has accumulated.<sup>17,18</sup> In particular, the Italian Network of Longitudinal Metropolitan Studies has produced the best evidence available so far on the health of immigrants resident in Italy, confirming their advantage in terms of mortality,<sup>19,20</sup> but also highlighting a variable excess of risk for outcomes that are more sensitive to the effect of socioeconomic disadvantage.<sup>21-24</sup> However, little is known about the relationship between immigrant status and the different components of the individual socioeconomic position, which affect health through a multiplicity of processes.

It is widely acknowledged that cultural resources have a strong impact on health through a variety of mechanisms, ranging from a less attentive attitude towards prevention and perception of health problems, to a more likely adoption of harmful behaviours and a reduced ability to access health services or to manage one's own disease.<sup>25</sup> More-

over, the educational qualification is still the greatest determinant of an individual's job opportunities and career prospects.<sup>26</sup> In turn, employment affects health as a source of income and economic well-being, and specific positions and working conditions can expose to physical, chemical, and biological hazards, as well as psychosocial stressors.<sup>25</sup> In 2017, a work conducted by Pacelli et al. on data from the Emilian Longitudinal Study, which includes the cities of Bologna, Modena, and Reggio Emilia (all located in Emilia-Romagna Region, Northern Italy), aimed to analyse the socioeconomic gradient in mortality among resident immigrants and compare it with that of the native population.<sup>27</sup> The results showed a flat educational gradient among male immigrants and the main interpretative hypothesis was the presence of a status inconsistency, according to which the educational qualification would not give immigrants the same employment and income potential as it does for Italians. Status inconsistency has been defined as a discrepancy between the position a person holds in one domain of his/her social life and his/her position in another domain, such as the mismatch between high educational attainment and employment in a low-skilled job.<sup>28</sup> The present work, which builds on this preliminary study and extends the analysis to data from the Turin Longitudinal Study, aims to compare the educational gradient between Italians and immigrants and to assess the hypothesis of status inconsistency and the use-value of education in the resident immigrant population, evaluating the relationship between educational qualification, occupational class and mortality.

## MATERIALS AND METHODS

### STUDY POPULATION

The data sources are the Turin Longitudinal Study (TLS) and the Emilian Longitudinal Study (SLEm); both are based on the individual record-linkage between the municipal historical registries, the population census, the mortality registers, and the administrative health information systems.<sup>29-31</sup> The study population consists of subjects who were resident in one of the four cities (Turin, Bologna, Modena, Reggio Emilia), took part in the 2011 Census, were 30-64 years old at census time, and were not living in community settings. The threshold of 30 years was chosen, because educational qualifications can be considered sufficiently stable above that age; the restriction to 64 years was applied in order to analyse a population in the active age group and to exclude older people, who are underrepresented among the immigrant population.

In the 2011 Census, two versions of the questionnaire were adopted in the municipalities with 20,000 or more inhabitants: a short form collecting essential sociodemographic characteristics of the entire resident population; and a long form asking for additional information, administered to a representative sample of 33% of households. The four municipalities under study were involved in this sampling

strategy and, therefore, both the complete cohort and the long form sample (“LF sample”) were analysed.

A mortality follow-up was built for the period 09.10.2011 (Census date) to 31.12.2018, with a closed cohort approach. The outcome of interest is all-cause mortality, whose information was retrieved from the municipal and the mortality registers. The person-years (py) at risk were calculated from the baseline until the date of the first event: death, attainment of 65<sup>th</sup> year of age, emigration, or end of follow-up.

The subjects enrolled in the cohort were grouped according to their citizenship, recorded in the municipal register, in two main groups: Italians and immigrants from HMPC (see details in table S1, on-line supplementary materials). Foreigners with citizenship of one of the highly-developed countries were excluded from the analyses, because they are a small subgroup (about 4% of the foreign residents) and generally have a health profile comparable to the native population.<sup>13</sup> Immigrants were further classified according to the macroarea of origin, based on the citizenship, divided into Central-Eastern Europe (CEE), Africa, Central-South America, and Asia (details in table S1). Stateless persons were excluded from the analysis due to their low number, which did not allow treating them as a separate group (0.6 x1,000 py).

#### EXPOSURE AND ADJUSTMENT VARIABLES

The educational qualification is the main exposure; it is based on the highest qualification declared in the 2011 Census and classified in four levels: degree or higher qualifications, high-school diploma, middle school and vocational diploma, primary school or less. To assess the hypothesis of status inconsistency, a modified version of the occupational class model proposed by Erikson-Goldthorpe (EGP) was used, already validated in the epidemiological field.<sup>32</sup> The classification is based on the combination of Census information on employment status, type of work activity, and position in the profession, the latter only present in the long form version of the questionnaire. Compared to the original version, jobs related to services to individuals (originally included in the class of non-manual workers) are treated as a stand-alone group in order to investigate possible specific differences among foreign women, often employed in these activities. Therefore, the occupational class variable – available only for the LF sample – includes six categories: **1.** non-manual workers (professionals, managers, skilled technicians, office workers); **2.** self-employed workers (including farmers and stock-breeders); **3.** sales and services workers; **4.** manual workers (skilled and unskilled); **5.** Unemployed; **6.** other inactive persons (housewives, students, retired or otherwise). Workers employed in the army were excluded from the analyses as foreigners are underrepresented in this sector. Adjustment variables were the city of residence, the two-year calendar period (2011-2012; 2013-2014; 2015-2016;

2017-2018) and 5-year age class, the latter two treated as time dependent variables. The analyses for HMPC immigrants were also adjusted for macroareas of origin.

#### STATISTICAL ANALYSIS

All the analyses were stratified by gender and citizenship. The risk of all-cause mortality by educational qualification was estimated through Mortality Rate Ratios (MRRs) and relative 95% Confidence Intervals (95%CI) applying Poisson regression models with robust standard errors.<sup>33</sup> The educational gradient was also estimated through the Relative Index of Inequality (RII),<sup>34,35</sup> to allow a straighter comparison between Italians and immigrants and across the different models.

Three main multivariable analyses were carried out. The first was performed on the complete cohort to estimate the adjusted MRRs by educational qualification. The second analysis was carried out by applying the same model to the LF sample to observe any changes in the educational gradient due to sampling. In the third analysis, the occupational class variable was included in the second model to evaluate its potential mediating role in the association between education and mortality.

Analyses were carried out using the STATA/SE 13 software.

#### RESULTS

The individuals in the four cohorts contribute for a total of 4,541,710 py (55% in Turin, 23% in Bologna, 11% in Modena, 11% in Reggio Emilia). Immigrants from HMPC count for about 13% of the time-at-risk, with slight differences by city (table 1). Immigrants are generally younger than Italians.

The composition of the immigrant group in terms of macroarea of origin also differs between the four cities and by gender (table 1 for the entire cohort and table S2 for the LF sample). The most represented is the CEE citizenship, driven by its prevalence in Turin, which is over 50% in both genders. Asians are most represented in Bologna, while Africans in Modena and Reggio Emilia, particularly among men.

Italians hold higher educational qualifications than HMPC immigrants. The proportion of subjects with a high school diploma or a degree is 61% and 59% among Italians women and men, respectively, and 45% and 38% among the immigrant counterpart (tables 2).

Subjects in the LF sample contribute to 39% and 50% of the total time-at-risk among Italian and HMPC immigrants, respectively. The distribution of demographic characteristics and educational qualifications substantially reflects that of the full cohort. There is a slight over-representation of the foreign population, which increases the proportion of py by about 3 percentage points in all cities. The analysis of the distribution of the occupational class by educational qualification, stratified by gender and citizenship, reveals great differences (figure 1). Italian men

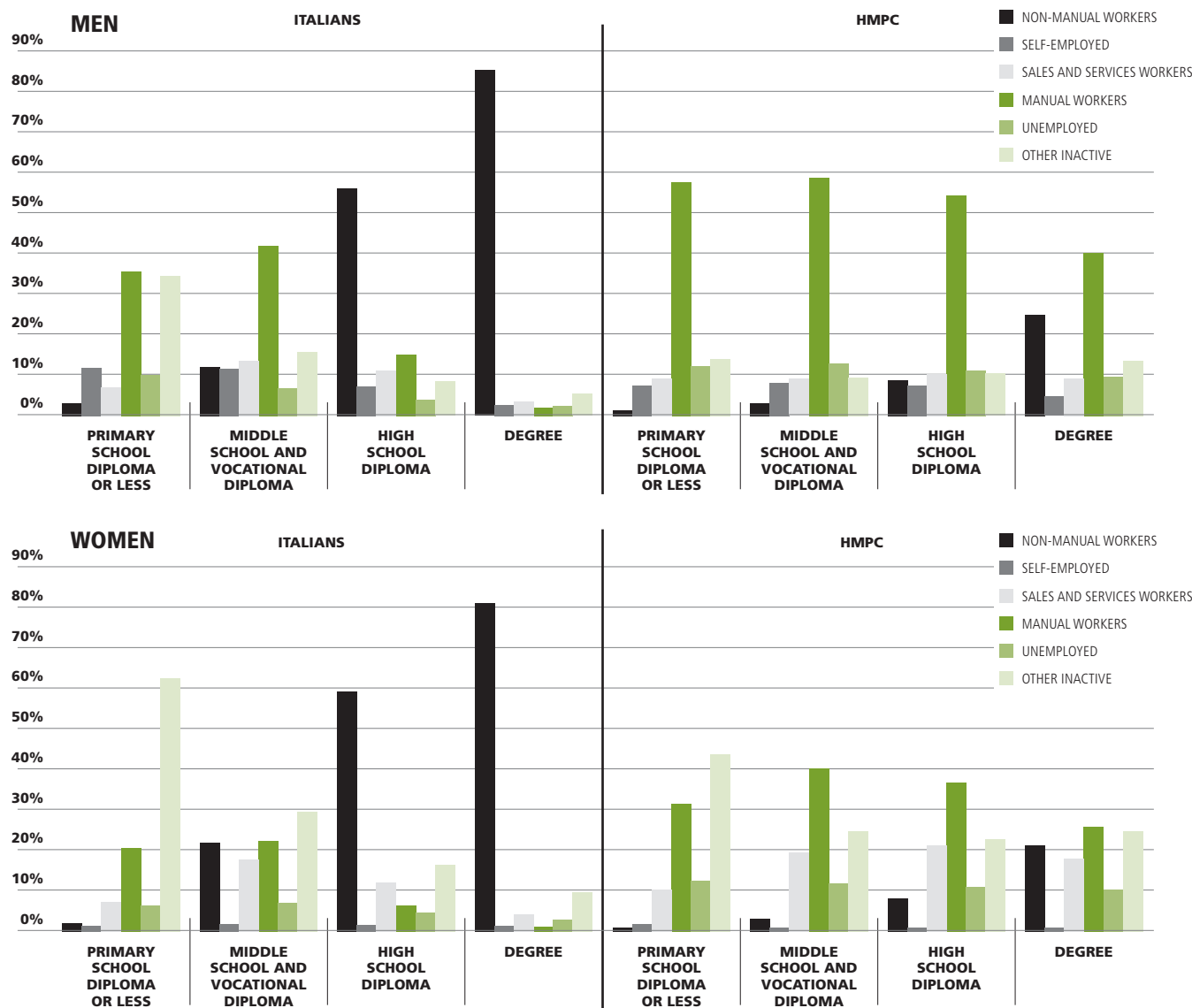
COMPLETE COHORT	TURIN		BOLOGNA		MODENA		REGGIO EMILIA		TOTAL	
	PY (%)	DEATHS	PY (%)	DEATHS	PY (%)	DEATHS	PY (%)	DEATHS	PY (%)	DEATHS
<b>MEN</b>	<b>1,202,522</b>	<b>3,530</b>	<b>504,038</b>	<b>1,461</b>	<b>235,754</b>	<b>565</b>	<b>239,587</b>	<b>594</b>	<b>2,181,901</b>	<b>6,150</b>
<b>CITIZENSHIP (% TOTAL)</b>										
Italians	1,047,340 (87.1)	3,305	452,177 (89.7)	1,371	211,069 (89.5)	531	206,750 (86.3)	544	1,917,336 (87.9)	5,751
HMPC	155,182 (12.9)	225	51,861 (10.3)	90	24,685 (10.5)	34	32,837 (13.7)	50	264,565 (12.1)	399
<b>OF WHICH (% HMPC):</b>										
Central and Eastern Europe	81,015 (52.2)	136	14,231 (27.4)	40	8,510 (34.5)	13	10,631 (32.4)	13	114,387 (43.2)	202
Africa	43,854 (28.3)	49	8,991 (17.3)	14	10,489 (42.5)	15	14,785 (45.0)	28	78,118 (29.5)	106
Central and South America	14,901 (9.6)	18	2,372 (4.6)	4	909 (3.7)	1	837 (2.5)	2	19,019 (7.2)	25
Asia	15,412 (9.9)	22	26,268 (50.7)	32	4,776 (19.3)	5	6,584 (20.1)	7	53,041 (20.0)	66
<b>WOMEN</b>	<b>1,302,414</b>	<b>2,360</b>	<b>549,401</b>	<b>1,004</b>	<b>258,519</b>	<b>399</b>	<b>249,475</b>	<b>392</b>	<b>2,359,810</b>	<b>4,155</b>
<b>CITIZENSHIP (% TOTAL):</b>										
Italians	1,114,297 (85.6)	2,208	483,277 (88.0)	940	225,407 (87.2)	372	210,946 (84.6)	360	2,033,927 (86.2)	3,880
HMPC	188,118 (14.4)	152	66,124 (12.0)	64	33,113 (12.8)	27	38,528 (15.4)	32	325,883 (13.8)	275
<b>OF WHICH (% HMPC):</b>										
Central and Eastern Europe	108,795 (57.8)	82	34,795 (52.6)	31	17,316 (52.3)	15	19,146 (49.7)	13	180,053 (55.3)	141
Africa	34,601 (18.4)	43	7,503 (11.3)	7	8,349 (25.2)	8	10,326 (26.8)	11	60,779 (18.7)	69
Central and South America	28,289 (15.0)	20	4,524 (6.8)	4	2,143 (6.5)	1	2,353 (6.1)	3	37,309 (11.4)	28
Asia	16,432 (8.7)	7	19,302 (29.2)	22	5,304 (16.0)	3	6,703 (17.4)	5	47,742 (14.6)	37

**Table 1.** Numbers and percentages of person-year (py) and deaths, by gender and citizenship in the four cohorts (complete cohort), 30-64 years, 2011-2018.

**Tabella 1.** Numero e percentuale di anni-persona (py) e decessi, per genere e cittadinanza nelle quattro coorti (coorte completa), età 30-64, 2011-2018.

and women are more often employed in non-manual jobs (men: 44%; women: 50%), with a proportion that increases considerably with education. Conversely, immigrants are mainly employed in manual works (men: 55%; women: 36%), and the proportion is only slightly lower among graduates, but substantially invariable by educational qualification. The proportion of immigrants in non-manual jobs is concentrated among graduates, but remains just over 20% for both genders. Among immigrant women, employment in sales and services is higher than among Italian women (19% *vs* 11%) and does not decrease with increasing education, as it does among Italians. Among immigrants, unemployment is approximately twice as common as Italians while the proportion of inactive subjects is lower than among Italians (16% *vs* 19%), with little variation across educational qualifications for both genders. Between 09.10.2011 and 31.12.2018 there were 5,751 deaths among Italian men and 399 among HMPC men (table 2a). In the complete cohort, the educational gradient is strong among Italians (RII 3.32; 95%CI 2.97-3.71) and

weak and not statistically significant among immigrants. In the model restricted to the LF sample, the MRRs and the RIIs by educational qualification tend to increase among both Italians (RII 3.74; 95%CI 3.14-4.45) and immigrants, although still not significantly among the latter (RII 1.58; 95%CI 0.93-2.70). In the third model, which also includes the occupational class variable, the strength of the association between education and mortality and the gradient show an attenuation among Italians. Among immigrants, this further adjustment does not produce significant changes in either the MRRs or the RIIs. There is also a strong independent effect of the occupational class among Italians, with an excess risk for manual workers, the unemployed and other inactive workers compared to non-manual workers. Among HMPC immigrants, an excess of risk is significant only for inactive subjects (MRR 2.05; 95%CI 1.04-4.02). Regarding the macroarea of origin, MRRs estimates remain essentially unchanged in the three models: compared to citizens from CEE, all other macroareas appear to have a lower mortality rate, statistically significant for Asians.



**Figure 1.** Percentages of person-year (py), by education level and occupational class, of (A) men and (B) women, by citizenship, 30-64 years, 2011-2018, LF sample.  
**Figura 1.** Percentuale di anni-persona (py), per titolo di studio e classe occupazionale di (A) uomini e donne (B) per cittadinanza, 30-64, 2011-2018, campione LF.

Among women (table 2b), there were 3,880 deaths among Italians and 275 among immigrants. In the complete cohort, the educational gradient in mortality is significant among Italians (RII 2.00; IC95% 1.76-2.27) and not significant among immigrants, although the MRRs and RII estimates indicate an inverse gradient. In the LF sample estimates slightly decrease among Italians (RII 1.85; 95%CI 1.51-2.26), while the gradient turns to flat among immigrants. The adjustment for occupational class in the third model, contributes to attenuate further the MRRs by educational qualification among Italians, and the RII loses significance. In addition, there is an independent effect of the occupational class, with an excess risk compared to non-manual workers in all classes, but sales and services workers. Among immigrants, the absence of an educational gradient persists and there is not any significant association with occupational class. Regarding the macroarea of origin, there is a significant excess of mortality only among African women, which diminishes and loses significance with the adjustment for occupational class.

## DISCUSSION

### MAIN RESULTS AND COMPARISON WITH OTHER STUDIES

The aim of this study was to compare the educational gradient in mortality between Italians and immigrants from highly migratory pressure countries, and to explore the hypothesis of status inconsistency as a possible explanation. The results show the absence of a significant gradient among immigrants of both genders, as opposed to what is observed among Italians. The occupational class partially contributes to explaining the educational gradient among Italians, while it does not modify the association between education and mortality among immigrants. Moreover, the proportion of subjects in manual occupations or inactive status is very high and substantially constant across the educational qualifications among immigrants, contrary to the distribution of low-skilled jobs among Italians, which are concentrated in the low educated. These results, taken together, lend weight to the hypothesis of a status inconsistency effect among immigrants.



<b>MEN</b>							
	<b>COMPLETE COHORT</b>			<b>LF SAMPLE</b>			
	<b>PY (%)</b>	<b>DEATHS</b>	<b>MRR* (95%CI)</b>	<b>PY (%)</b>	<b>DEATHS</b>	<b>MRR** (95%CI)</b>	<b>MRR*** (95%CI)</b>
<b>ITALIANS</b>							
<b>Total</b>	<b>1,917,336</b>	<b>5,751</b>		<b>752,509</b>	<b>2,259</b>		
<b>EDUCATIONAL QUALIFICATION</b>							
Degree	476,078 (24.8)	781	1.00	184,760 (24.6)	284	1.00	1.00
High school diploma	655,307 (34.2)	1,529	1.36 (1.24-1.48)	257,674 (34.2)	601	1.46 (1.26-1.69)	1.26 (1.09-1.47)
Middle school and vocational school diploma	696,930 (36.3)	2,722	2.08 (1.91-2.27)	274,276 (36.4)	1,068	2.24 (1.95-2.58)	1.57 (1.34-1.84)
Primary school diploma or less	89,021 (4.6)	719	2.82 (2.52-3.16)	35,799 (4.8)	306	3.24 (2.72-3.87)	2.02 (1.67-2.46)
<b>RII</b>			<b>3.32 (2.97-3.71)</b>			<b>3.74 (3.14-4.45)</b>	<b>2.13 (1.73-2.61)</b>
<b>OCCUPATIONAL CLASS</b>							
Non-manual workers				334,486 (44.4)	530		1.00
Self-employed				57,420 (7.6)	127		1.05 (0.85-1.28)
Sales and services workers				72,301 (9.6)	149		1.14 (0.94-1.39)
Manual workers				168,454 (22.4)	426		1.28 (1.10-1.49)
Unemployed				35,379 (4.7)	169		2.53 (2.10-3.04)
Other inactive				84,470 (11.2)	858		3.57 (3.09-4.12)
<b>HMPC</b>							
<b>Total</b>	<b>264,565</b>	<b>399</b>		<b>135,199</b>	<b>196</b>		
<b>EDUCATIONAL QUALIFICATION</b>							
Degree	30,407 (11.5)	41	1.00	15,849 (11.7)	16	1.00	1.00
High school diploma	71,161 (26.9)	98	0.99 (0.68-1.42)	36,862 (27.3)	53	1.35 (0.77-2.37)	1.43 (0.80-2.55)
Middle school and vocational diploma	132,928 (50.2)	204	1.18 (0.84-1.66)	66,192 (49.0)	93	1.41 (0.83-2.40)	1.48 (0.85-2.56)
Primary school diploma or less	30,069 (11.4)	56	1.26 (0.84-1.89)	16,296 (12.1)	34	1.78 (0.98-3.23)	1.81 (0.98-3.37)
<b>RII</b>			<b>1.40 (0.97-2.02)</b>			<b>1.58 (0.93-2.70)</b>	<b>1.57 (0.91-2.69)</b>
<b>OCCUPATIONAL CLASS</b>							
Non-manual workers				9,066 (6.7)	11		1.00
Self-employed				9,769 (7.2)	11		0.83 (0.34-1.98)
Sales and services workers				12,317 (9.1)	7		0.48 (0.18-1.26)
Manual workers				74,501 (55.1)	88		0.84 (0.44-1.61)
Unemployed				15,559 (11.5)	31		1.30 (0.63-2.66)
Other inactive				13,988 (10.3)	48		1.98 (1.01-3.87)
<b>MACRO-AREA</b>							
Central and Eastern Europe	114,387 (43.2)	202	1.00	55,537 (41.1)	96	1.00	1.00
Africa	78,118 (29.5)	106	0.73 (0.57-0.93)	43,425 (32.1)	56	0.71 (0.50-1.00)	0.71 (0.51-1.00)
Central and South America	19,019 (7.2)	25	0.71 (0.46-1.07)	9,170 (6.8)	13	0.79 (0.44-1.43)	0.83 (0.46-1.50)
Asia	53,041 (20.0)	66	0.59 (0.43-0.79)	27,068 (20.0)	31	0.59 (0.38-0.91)	0.63 (0.41-0.97)

\* Model 1: models adjusted for city cohort, calendar in two-year classes, age in five-year classes and (only HMPC) macro-area of origin / *Modello 1: modelli aggiustati per città, periodo di calendario in classi biennali, età in classi quinquennali e (solo tra PFP) macroarea di origine*

\*\* Model 2: as Model 1, restricted to the LF sample / *Modello 2: come il Modello 1, ristretto al campione LF*

\*\*\* Model 3: as Model 2, including occupational class / *Modello 3: come il Modello 2 con l'inclusione della classe occupazionale*

**CONTINUA ►**

**Table 2.** All-cause mortality among men: numbers and percentages of person-years (py) and deaths, mortality rate ratios (MRR), relative index of inequality (RII), and 95% confidence intervals (95%CI), by education level, occupational class, and macroarea of origin, by citizenship, 30-64 years, 2011-2018.

**Tabella 2.** Mortalità per tutte le cause tra gli uomini: numeri e percentuali di anni-persona (py) e decessi, rapporto tra i tassi di mortalità (MRR), indice di disuguaglianza relativa (RII) e intervalli di confidenza al 95%, per titolo di studio, classe occupazionale e macroarea di origine, per cittadinanza, età 30-64, 2011-2018.

## ► SEGUE

WOMEN	COMPLETE COHORT			LF SAMPLE			
	PY (%)	DEATHS	MRR* (95%CI)	PY (%)	DEATHS	MRR** (95%CI)	MRR*** (95%CI)
	<b>ITALIANS</b>						
<b>Total</b>	<b>2,033,927</b>	<b>3,880</b>		<b>783,001</b>	<b>1,492</b>		
<b>EDUCATIONAL QUALIFICATION</b>							
Degree	571,789 (28.1)	664	1.00	221,448 (28.3)	264	1.00	1.00
High school diploma	662,108 (32.6)	1,083	1.28 (1.16-1.42)	257,296 (32.9)	422	1.23 (1.05-1.44)	1.12 (0.95-1.31)
Middle school and vocational diploma	683,705 (33.6)	1,606	1.50 (1.36-1.64)	260,154 (33.2)	618	1.43 (1.23-1.67)	1.14 (0.97-1.35)
Primary school diploma or less	116,325 (5.7)	527	1.96 (1.73-2.23)	44,103 (5.6)	188	1.79 (1.46-2.19)	1.25 (1.00-1.55)
<b>RII</b>			<b>2.00 (1.76-2.27)</b>			<b>1.85 (1.51-2.26)</b>	<b>1.24 (0.99-1.55)</b>
<b>OCCUPATIONAL CLASS</b>							
Non-manual workers				389,563 (49.8)	459		1.00
Self-employed				11,901 (1.5)	28		1.69 (1.15-2.47)
Sales and services workers				88,802 (11.3)	125		1.21 (0.98-1.50)
Manual workers				85,449 (10.9)	145		1.23 (1.01-1.51)
Unemployed				39,575 (5.1)	60		1.37 (1.04-1.80)
Other inactive				167,711 (21.4)	675		2.24 (1.94-2.60)
<b>HMPC</b>							
<b>Total</b>	<b>325,883</b>	<b>275</b>		<b>157,552</b>	<b>125</b>		
<b>EDUCATIONAL QUALIFICATION</b>							
Degree	51,040 (15.7)	33	1.00	24,204 (15.4)	17	1.00	1.00
High school diploma	96,407 (29.6)	74	1.15 (0.76-1.74)	46,865 (29.7)	36	1.04 (0.58-1.87)	1.09 (0.62-1.94)
Middle school and vocational diploma	143,228 (44.0)	124	1.28 (0.87-1.88)	68,194 (43.3)	54	1.06 (0.62-1.83)	1.11 (0.65-1.89)
Primary school diploma or less	35,207 (10.8)	44	1.36 (0.85-2.19)	18,288 (11.6)	18	0.98 (0.49-1.96)	0.87 (0.43-1.75)
<b>RII</b>			<b>1.40 (0.89-2.20)</b>			<b>1.01 (0.52-1.98)</b>	<b>0.92 (0.48-1.77)</b>
<b>OCCUPATIONAL CLASS</b>							
Non-manual workers				10,956 (7.0)	7		1.00
Self-employed				1,520 (1.0)	1		0.95 (0.12-7.80)
Sales and services workers				29,269 (18.6)	14		0.57 (0.23-1.39)
Manual workers				56,853 (36.1)	37		0.77 (0.35-1.69)
Unemployed				17,664 (11.2)	12		0.94 (0.38-2.32)
Other inactive				41,290 (26.2)	54		1.82 (0.84-3.95)
<b>MACROAREA</b>							
Central and Eastern Europe	180,053 (55.3)	141	1.00	86,260 (54.8)	64	1.00	1.00
Africa	60,779 (18.7)	69	1.68 (1.23-2.31)	31,482 (20.0)	33	1.80 (1.13-2.84)	1.49 (0.94-2.35)
Central and South America	37,309 (11.4)	28	0.98 (0.65-1.48)	17,357 (11.0)	14	1.16 (0.64-2.09)	1.18 (0.66-2.13)
Asia	47,742 (14.6)	37	0.99 (0.68-1.44)	22,453 (14.3)	14	0.86 (0.47-1.56)	0.78 (0.43-1.40)

\* Model 1: models adjusted for city cohort, calendar in two-year classes, age in five-year classes and (only HMPC) macro-area of origin / *Modello 1: modelli aggiustati per città, periodo di calendario in classi biennali, età in classi quinquennali e (solo tra PFP) macroarea di origine*

\*\* Model 2: as Model 1, restricted to the LF sample / *Modello 2: come il Modello 1, ristretto al campione LF*

\*\*\* Model 3: as Model 2, including occupational class / *Modello 3: come il Modello 2 con l'inclusione della classe occupazionale*

**Table 2.** All-cause mortality among women: numbers and percentages of person-years (py) and deaths, mortality rate ratios (MRR), relative index of inequality (RII), and 95% confidence intervals (95%CI), by education level, occupational class, and macroarea of origin, by citizenship, 30-64 years, 2011-2018.

**Tabella 2.** Mortalità per tutte le cause tra le donne: numeri e percentuali di anni-persona (py) e decessi, rapporto tra i tassi di mortalità (MRR), indice di disuguaglianza relativa (RII) e intervalli di confidenza al 95%, per titolo di studio, classe occupazionale e macroarea di origine, per cittadinanza, età 30-64, 2011-2018.

To the best of the Authors' knowledge, no other studies compared the educational gradient in mortality between immigrants and native populations. Instead, several studies analysed other socioeconomic indicators or other health outcomes, although they are not fully comparable with the one presented in this study, as most of them are based on cross-sectional survey or were conducted in countries with a much longer history of immigration and different characteristics compared to Italy. Nevertheless, their results are similar to the main findings here presented. In particular, two studies carried out in the USA, which looked at lifestyles and self-referred health, highlighted smaller educational gradients among immigrants, with a strong variability depending on the outcomes and the ethnic group considered.<sup>36,37</sup> Similarly, other studies conducted in Canada aiming to assess income inequalities in mortality and life expectancy found that gradients were less pronounced among immigrants than among long-term residents, and more intense among men than women.<sup>38,39</sup> An extensive literature on Latino immigrants in the USA showed a similar picture on a variety of outcomes such as morbidity, cardiovascular risk factors, and perinatal outcomes.<sup>16</sup> In Europe, studies mostly focused on the analysis of socioeconomic characteristics of the context rather than on individual ones. In addition, they found lower inequalities among immigrants than natives, both in relation to self-perceived health and disability indicators in the Netherlands and in premature mortality in Barcelona.<sup>40,41</sup>

### POSSIBLE EXPLANATIONS

The higher mortality among the lower educated, which was observed only among Italians in this study, is a consistent finding of a robust body of European research.<sup>42-44</sup> It is essentially linked to three possible mechanisms: the adoption of harmful health behaviours, a lower access to health services and a smaller probability of good job opportunities, and consequent social and economic well-being.<sup>25</sup>

In line with the reasoning introduced by Pacelli,<sup>27</sup> in this study the primary focus is to analyse the least studied mechanism, i.e., the relationship between educational qualification and occupational class, in order to evaluate the hypothesis of status inconsistency between Italians and immigrants. The greater frequency of manual occupations among people with high educational qualifications, observed in particular among immigrant men, is a phenomenon known as over-qualification, which is the tendency to have an education level higher than that required for a certain job. This trend is higher in Italy than in other European countries<sup>45</sup> and generally more common among immigrants.<sup>46</sup> What was found is in line with the existing evidence showing that in Italy the percentage of over-qualification is 41% among Italians and reaches 95% among immigrants.<sup>47</sup> This phenomenon has several possible explanations:

- a limited legal and practical transferability of the qualifi-

cation and knowledge acquired in the country of origin to the Italian context;

- an information disadvantage about the opportunities offered by the labour market;

- languages difficulties that hamper the access to it, especially at the beginning of the immigration experience.

However, episodes of discrimination by employers cannot be excluded, as reported in a study which, by comparing white and black immigrants in the USA and South Africa, found that having racial characteristics similar to those of the local majority was associated with a lower degree of over-qualification.<sup>48</sup> A Swedish study also showed that a stable condition of over-qualification results in an increased risk of death even in the native population, whereas the under-qualification (having a qualification lower than that required for the job) seems to be protective.<sup>49</sup> This mechanism, more common among immigrants than among Italians, may have contributed to the levelling of differentials in education observed in the present study.

As for lifestyles, the national survey on "Conditions and social integration of foreign citizens", carried out by the Italian National Institute of Statistics (Istat), revealed that the prevalence of smoking and alcohol consumption is comparable between Italians and immigrants legally residing in Italy, while levels of overweight and obesity are higher among the latter.<sup>50</sup> However, huge differences exist between the macroareas of origin, with the highest frequencies among immigrants from CEE, low levels of smoking, and alcohol consumptions among Asian and North African immigrants, presumably for religious reasons, and a considerable excess of obesity among African women. In their multivariable analyses, moreover, the level of education lost significance, compared to the other considered sociodemographic factors, such as employment, family type, and birth area. The results by macroarea of origin completely mirror these risk profiles, showing a protective effect of all areas of origin compared to CEE, and a significantly higher risk of mortality only among African women. The documented absence of educational differentials in harmful lifestyles among immigrants contribute to explain their lower educational gradient in mortality compared to Italians. Looking at the indicators of healthcare services access, in the abovementioned survey immigrants also show a worst attitude towards prevention, especially among the low educated, and declare a higher number of hospitalisations and accesses to Emergency Room than Italians.<sup>50</sup> This is a warning sign for the health of immigrants; however, it may be too early to appreciate the effect of these behaviours on mortality which is the outcome analysed in this paper. Among other possible explanations, the 'healthy migrant effect' is often called into question, based on results showing that the health selection is more common in low socioeconomic strata, thus partly explaining the weak social gradients among immigrants.<sup>16,36</sup> In the considered cities, where immigration is relatively recent, the 'healthy migrant effect' still appears to



exist when looking at mortality.<sup>51</sup> Moreover, in a supplementary analysis (table S3) a higher protection compared to Italians among the less educated subjects was also observed, supporting the flat educational gradient. As mentioned before, mortality may not have been yet influenced by the process of assimilation, which generally results in social gradients comparable to those of the host population. However, the evaluation of other intermediate outcomes in the cohorts used for the present study suggests that immigrants' initial health advantage has begun to erode over time even in Italy.<sup>17,18,21-24,52</sup>

On the other side, in the light of the preliminary analysis of the immigrant population, which showed mortality increasing with age as expected, it seems that the 'salmon effect' is not an issue among the study population. Still, internal migration patterns may differ between Italians and immigrants, with the latter showing a higher propensity to move. If immigrants' movements are less likely to be recorded in the administrative databases, some information, including the death, may not be timely registered leading to an overestimation of the person-time at risk. The only significant excess mortality among immigrants was observed in the «other inactive» category, which is a highly-selected population group that includes those unable to work or retired before reaching retirement age. It could also include seasonal or undeclared workers, who, given the occasional nature of the job, could experience riskier working conditions.<sup>53</sup> An analysis by cause of death could contribute to investigate further this finding.

#### STRENGTHS AND LIMITATIONS OF THE STUDY

The main strength of this study is the use of data from the longitudinal studies of Turin and Emilia, which provide a very detailed image of the resident population, according to a plurality of sociodemographic characteristics collected through the national Census, and treated and classified consistently across the cities.<sup>31</sup> The cohort approach allows to estimate the precise time-at-risk at individual level; pooling the four cohorts considerably increases the power of the study. In addition, the death count in some subgroups (e.g., immigrant women) may be too low to appreciate significant effects, an issue that may be overcome in the future by extending the follow-up time and including other similar Italian cohorts. This will also allow the analysis by causes of death, therefore a greater deepening of the relationship between education, employment, and health. This study has also some limitations. The biggest one is the absence of the information on the length of stay, because it is not currently available either from the Census or from the municipal registers (which record the arrival in the municipality, but not in Italy). It is well known that as the length of stay increases, immigrants tend to lose their health advantage mainly through a process of assimilation that leads them to accumulate and experience health risks similar to those of the most disadvantaged native population groups,

as it has already reported for unhealthy lifestyles.<sup>50</sup> Therefore, adjusting for length of stay could have revealed greater differentials, which were likely weakened by the presence of more recently arrived immigrants. However, in this study, the focus was at the resident immigrant population, which is usually stable and with a long history of stay in Italy (given the law requirements for obtaining the residence permit). Therefore, the Authors do not believe that this limitation has substantially distorted the results. Another limitation is the potential misclassification of educational degree and employment among immigrants, which would lead to an underestimation of the risks. As mentioned, only the resident population who took part to the 2011 Census were enrolled; therefore, immigrants included in the cohorts, apart from having a long history of permanence in the country are likely to have a fair language proficiency, which should ensure greater accuracy of the information provided in the questionnaires.<sup>54</sup> However, a greater difficulty for foreigners to correctly labelling their occupation according to the complex Istat classification cannot be excluded. Finally, there is awareness that the immigrant population is not homogeneously distributed across countries neither with respect to socioeconomic determinants (table S4) nor for lifestyles or other health determinants. A stratified analysis by macroarea would have been preferable, but unfortunately the small numbers currently do not allow it. Pooling other cohorts and analysing longer follow-up periods or more frequent health outcomes may allow for more in-depth stratified analyses in the future.

#### CONCLUSIONS

The present work seems to support the hypothesis of a status inconsistency effect among immigrants in the considered Italian cities, which may be partly responsible for the observed flattening of the educational gradients. At the same time, other mechanisms, such as the healthy migrant effect and an even exposure to risky health behaviours by education, may be in place. Therefore, to explore social inequalities in the health of immigrant population, the use of educational qualification should always be complemented with other indicators of socioeconomic position. At the same time, intermediate health outcomes, which may be influenced by the assimilation process at an earlier stage, should also be analysed. Instead, the macroarea of origin appears to be a key determinant of mortality inequalities. Surveys and monitoring systems should consider investigating the dimensions which is currently difficult to trace from the administrative information systems, i.e., country of origin, reasons for migration, age on arrival, and length of stay in the host country.<sup>55</sup> Such information could contribute to trace the entire migratory process and fully understand the mechanisms that could jeopardise the health of immigrants, in order to preserve their health capital at arrival.

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