Assisted Reproductive Technology and pregnancy outcomes in Italy: between threats and opportunities

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ABSTRACT

Despite a restrictive legislation in Italy, ART has allowed new opportunities for many Italian couples previously considered sterile or desiring to have children at later age (72 thousands in 2011). The phenomenon – although still marginal (2.2% of births) – is having an impact on Italian fertility patterns (e.g. an increase of late fertility and of twin births) that in demographic literature on Italy is almost neglected. This paper tries to fill the knowledge gap using a combination of administrative data: Birth Assistance Certificate (CEDAP) data set and the Register of miscarriages (AS). Three are the research questions. First, we want to identify the differential characteristics (e.g. age, education, citizenship, residence) distinguishing mothers giving births by ART fecundation from those who have not used ART. Second, we evaluate whether the pregnancies and the deliveries when ART fecundation is used are different to a certain extent from the average (for instance in terms of duration of gestation, of medicalization of pregnancy, of the type of delivery). Finally, we investigate whether ART fecundation (according to different techniques) may influence the probability to have a live birth versus an adverse outcome (miscarriage or stillbirth).
First results show that ART treatment is more often linked to mother's higher age at birth and childlessness. Unexpectedly, there is small effect of education and occupational status on ART conception. Conception by ART is linked to a (perceived?) more risky pregnancy, premature births and not physiological delivery. It is not found a significant effect of the method of ART used on the likelihood to have a live birth versus an adverse outcome. A younger age and no previous miscarriages are factors linked to reproductive success.

Keywords: ART, Fertility patterns, Pregnancies, Deliveries, Miscarriages, Still birth

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Background and aim of the paper

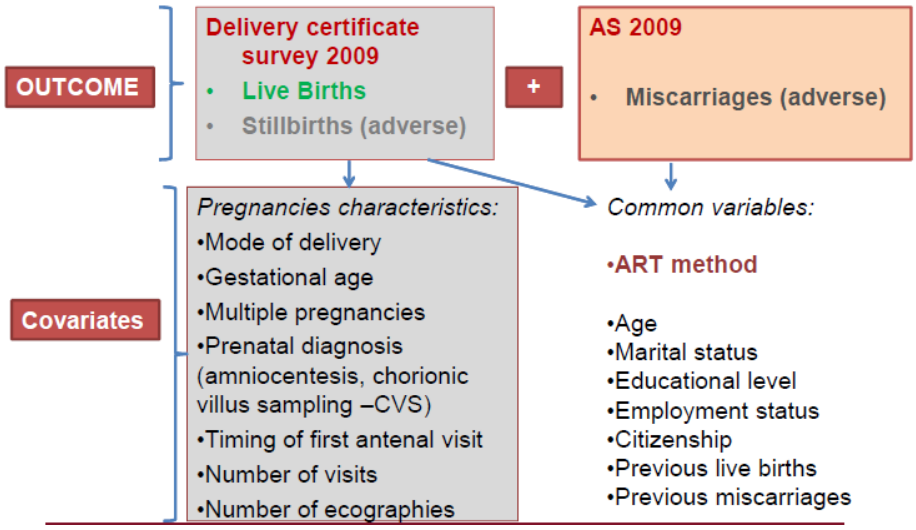
In the last decades, Italy has experienced massive changes in the postponement at the age of having a first child, shrinking family size, and increased (in)voluntary childlessness. The rise in late fertility and sterility impairments play a role to the rapid diffusion of various types of Assisted Reproductive Technologies (ART). Despite a restrictive legislation in Italy, ART has allowed new opportunities for many Italian couples previously considered sterile or desiring to have children at later age. However a conception by ART could result to be a threat in terms of adverse outcomes (e.g. miscarriages, still birth) or in terms of a pathological pregnancies or delivery (e.g. medicalisation of gestation, caesarean delivery).
The investigation of this topic is particularly important since the recent spread of ART usage. Data collected by the Italian Assisted Reproductive Technologies Register (IARTR) shows that -although the use of ART is still relatively rare as compared to the potential demand - its use has increased of 56 per cent over six years from 46 thousands couples in 2005 up to more than 72 thousands in 2011. However, this data includes only those couples who received ART treatment in one of the authorised centers in Italy, while there are no official information on those travelling abroad for fertility treatments (Zanini 2013). The Osservatorio per il Turismo Procreativo (Observatory for Procreative Tourism) - managed by the Italian Association CECOS (Center for Study and Preservation of Eggs and Sperm) - estimates that around 4 thousands Italian couple undertook cross-border reproductive care in 2011 (50% of which looking for heterologous fecundation that is not legally authorised in Italy). In line with other European Countries, ART efficaciousness is increasing in Italy as well (de Mouzon et al. 2010). One woman out of four succeeds in getting pregnant after ART treatment, and 77% of them give a live births at the delivery. Births from ART fecundations were close 12 thousands in 2011 (around 2.2% of the total births of the year), while six years before were approximately 5 thousands.
The phenomenon – although still marginal – is having an impact on Italian fertility patterns (e.g. an increase of late fertility and of twin births) but in demographic literature on Italy is almost neglected. The lack of opportune micro data to study the phenomenon are among the main reason that inhibit demographic studies on this topic. This paper tries to fill the knowledge gap and to answer to three basic research questions. First, we want to identify the differential characteristics (e.g. age, education, citizenship, residence) distinguishing mothers giving births by ART fecundation from those who have not used ART. Second, we evaluate whether the pregnancies and the deliveries when ART fecundation is used are different to a certain extent from the average (for instance in terms of duration of gestation, of medicalization of pregnancy, of the type of delivery). Finally, we investigate whether ART fecundation (according to different techniques) may influence the probability to have a live birth versus an adverse outcome (miscarriage or stillbirth).

Data and methods

This contribution focuses on the outcome of pregnancies from an ART treatment, using an opportune combination of different source of administrative data. The originality of this paper is to merge two different data sets: Birth Assistance Certificate (CEDAP) data set and the Register of miscarriages (AS), both collected in 2009, respectively by the Ministry of Health and ISTAT. CEDAP is a continuative data source since 2002 on about 550.000 annual deliveries, collected in

Hospital's births department. The data set contains information on parents' socio-demographic ibackground (age, residence, citizenship, marital status, education, profession), mother's reproductive history (parity, live births, stillbirths, previous induced abortions, previous miscarriages), pregnancy characteristics (medical examinations, echographies, gestational age, etc.), assisted reproductive technology (by type), delivery (place of birth, mode of delivery, date of birth, plurality, etc...), neonatal characteristics (sex, external genitals, birth weight, length, vital status, neonatal presentation, etc...), fetal mortality, presence of malformations.
AS is a continuative source since 1979, containing information on miscarriages occurred in both private and public hospital. Of course, there are no information on miscarriages occurred at home. AS contains information on woman's socio-demographic information (age, residence, citizenship, marital status, education, profession), woman's reproductive history (live births, stillbirths, previous induced abortions, previous miscarriages), on miscarriage (gestational age, kind of operation, analgesic therapy, length of stay in hospital, complications. Since 2000, also information on ART treatments are collected.
In order to delineate the differential characteristics distinguishing mothers who give births by ART fecundation from those who have not used ART, a logit model is estimated, using data from CEDAP. With the same data source, a second logit model allows to evidence pregnancy and delivery's features, linked to a birth conceived by ART, compared to a birth without the use of ART. Thirdly, through a multinomial logit we shows whether ART treatments (according to the kind of treatment) increase the likelihood of having an adverse outcome instead of a live birth. In the last case we combine opportunely the two different data source according the framework in Fig. 1.

Fig. 1 Use of data source to study the probability of adverse outcome.



Unfortunately we do not have data on induced abortion after ART conception, because the data set on abortions do not collect information on the type of conception. With respect to the information collected by the Italian Assisted Reproductive Technologies Register (IARTR), CEDAP data set has also information on exclusively pharmacological methods of ART, and in theory also on ART treatments received abroad among those who give birth in Italy. Nevertheless, ART use is underestimated compared to the ART National Register data: it is possible that some mothers prefer to omit to give this information at the delivery, for some reasons.
After a first data quality analysis, we realized that it is impossible to carry out the analysis at national level, but only on selected regions
On CeDAP, we have no data on an Italian region called Molise. In Lazio region there is no information on ART. Large proportion of missing data for covariates in Marche, Campania, Basilicata, Calabria, Sicilia make impossible to use the data set. Piemonte, Lombardia, Trentino-

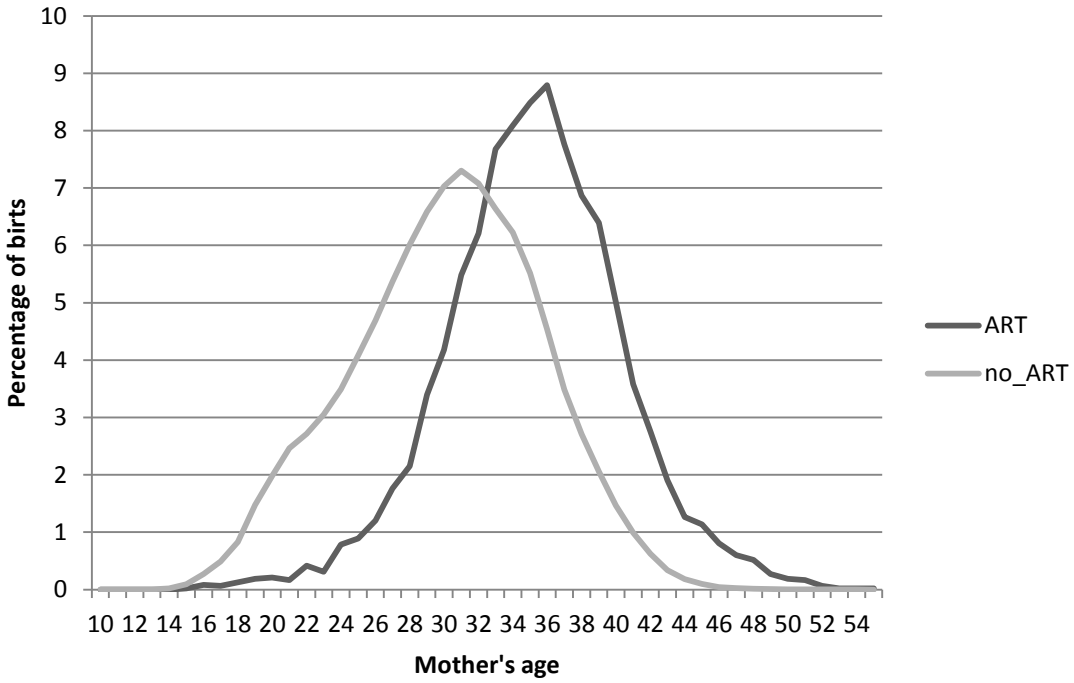
Alto Adige, Emilia-Romagna, Toscana are the only regions having good quality data for both data sources, and therefore we decide to carried out the analysis on adverse outcome exclusively on these regions where data quality is good.

Preliminary results

a. Mothers characteristics

Descriptive results shows that women giving birth by ART fecundations are on average older than the others (average age is 35.7 years old versus 31.8) and most of them have a first birth (81% versus 51%). In fig. 2, we compare the age pattern of first births by type of fecundation. Not surprisingly those who conceived thanks to ART treatments shows a delayed age profile. The modal age for the first birth is 31 for a fecundation without ART and 36 for births conceived by ART treatments, and the latter case the percentages of births remain high until around 40.

Fig. 2 Percentage of first birth by mother's age, according to the type of conception.



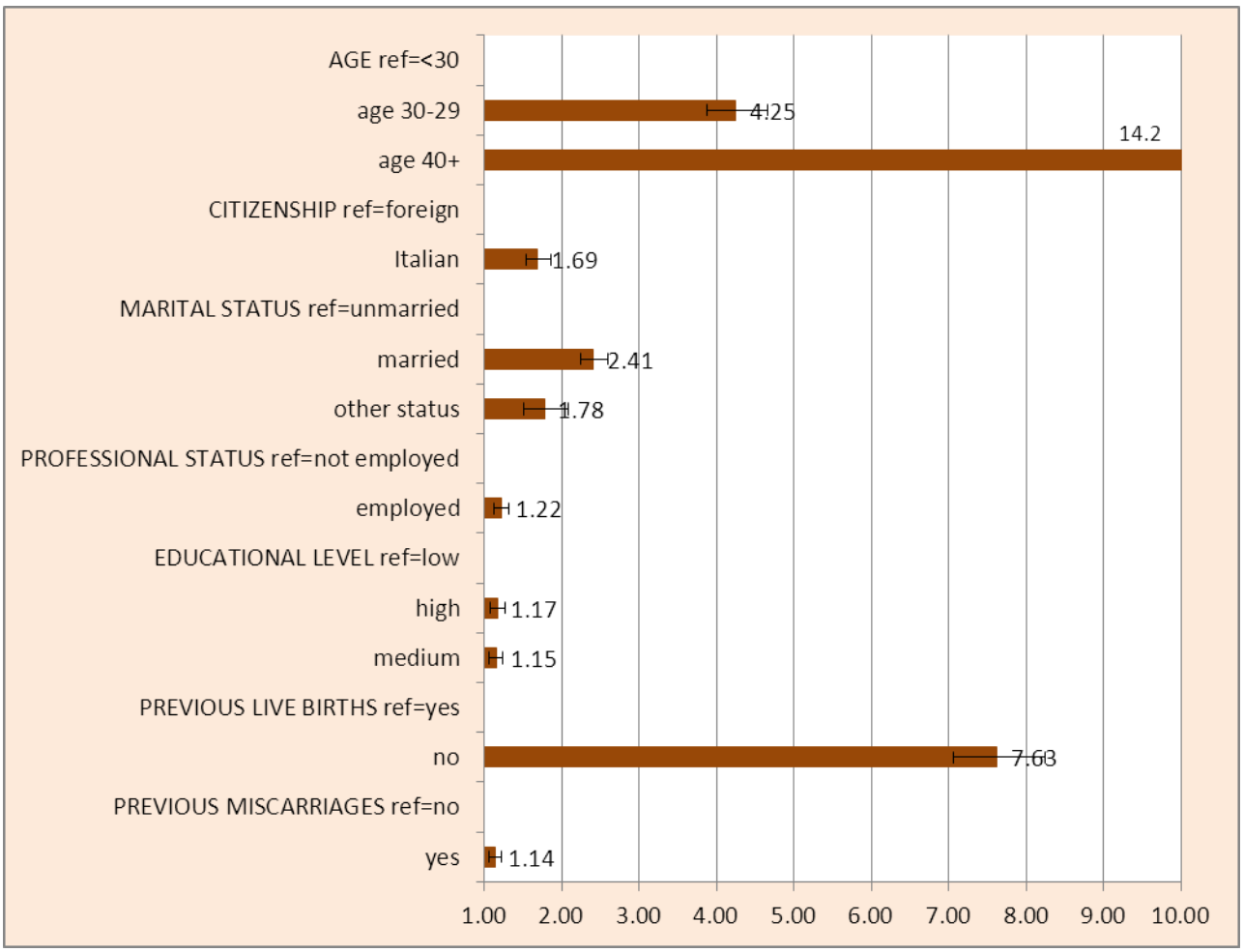
Source: CEDAP 2009

A smaller age difference is observed among men: 38.6 versus 35.4. With regard to socio-demographic characteristics the mothers who used ART treatment are more often married, more educated and more rarely foreign citizens (8% versus 18,7%). They had more frequently experienced one or more spontaneous miscarriages before the delivery (but the differences disappear once we control for age).

In a logit model we verify whether these results hold also net to the other factors. Results in fig.2 evidence that compared to those giving birth in their twenties, mothers having a birth in their thirties they are more than 4 times more likely to have used ART, while this odds increases up to 14 times if they give birth in their forties. They are also more likely to be at first birth, net to the other factors. Italian mothers are 69% more likely to use ART fecundation than the foreigners. They are also sensibly more likely to be married. Surprisingly the effect of employment status is small in

magnitude (working mothers are 22% more likely to have used ART), as well as the education level. Having experienced previous miscarriages increase of 14% the probability to use ART to conceive, net to the other factors as age.

Fig. 3 Results of a logit model contrasting the characteristics of mothers who conceived by ART treatments versus those who did not. Odds ratios.

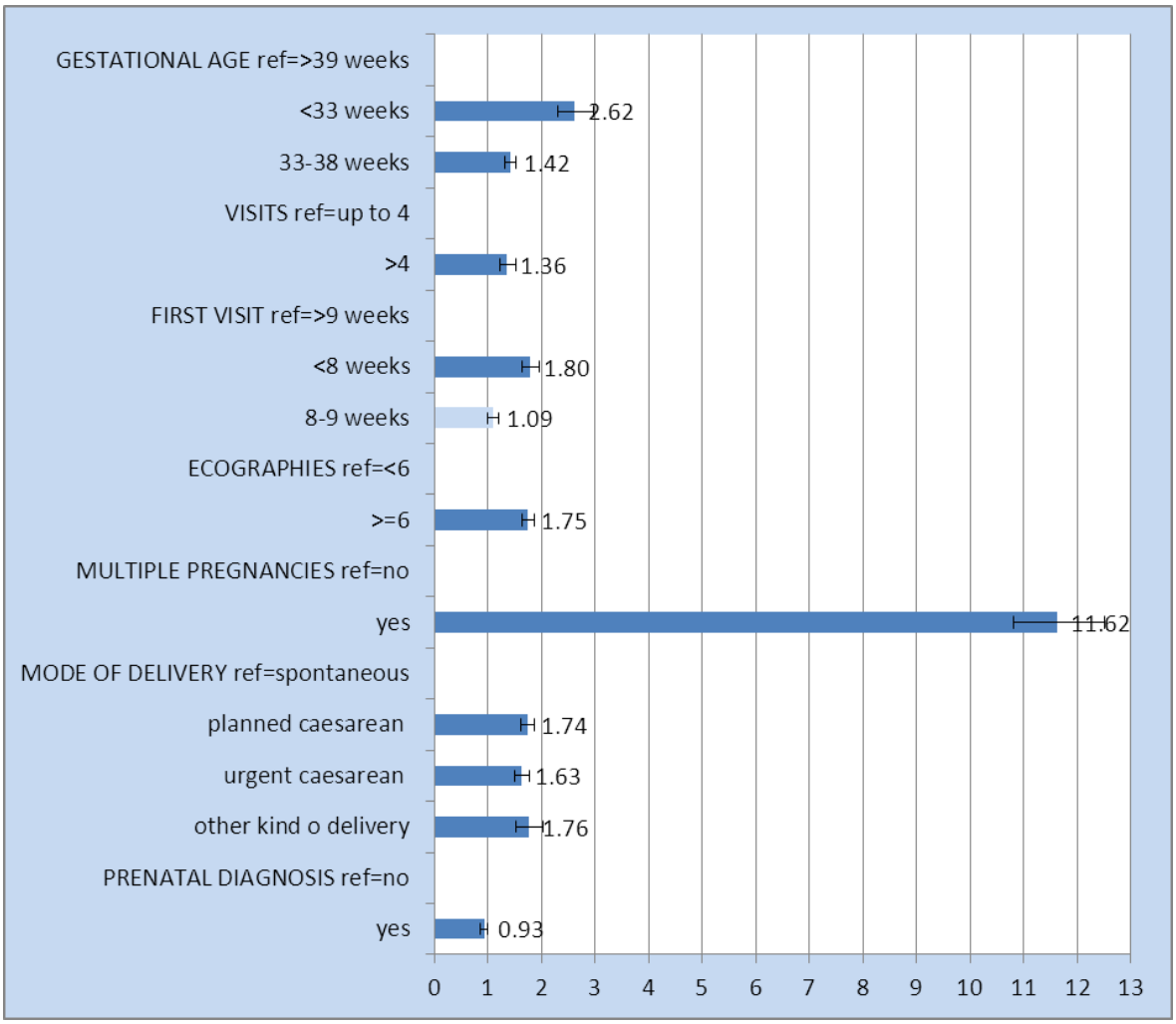


Source: CEDAP 2009

b. Pregnancies and delivery characteristics

Descriptive analysis shows that pregnancies by ART fecundations are more medicalised (e.g. more ecographies, more pre-natal tests). Similarly among those using ART treatments on average more premature births (37 weeks of gestation versus 39), more multiple births (21.5% have twins versus 1.3%) and more caesarean deliveries (59% versus 37%) occur. Most of these effects could be a consequence of higher mothers' age at birth. Therefore a logit model have been estimated to study the differential characteristics of pregnancies and deliveries controlling for other covariates as age. Results in fig. 4 shows that premature birth (between the 32nd and the 38th week) and either caesarean delivery (both planned and urgent) or not physiological deliveries are more likely to occur when a child is conceived by ART treatment, even controlling for the age. Similarly, multiple births are remarkably much more common among women treated with ART (more than one treated women out five have twins, versus 1.3% of the others). Model results confirm that pregnancies of women who conceived using ART are much more medicalised (e.g. more ecographies and visit, a first visit more precocious, more pre-natal exams).

Fig. 4 Results of a logit model contrasting the characteristics of pregnancies and deliveries obtained by ART treatments versus those who did not. Odds ratios.

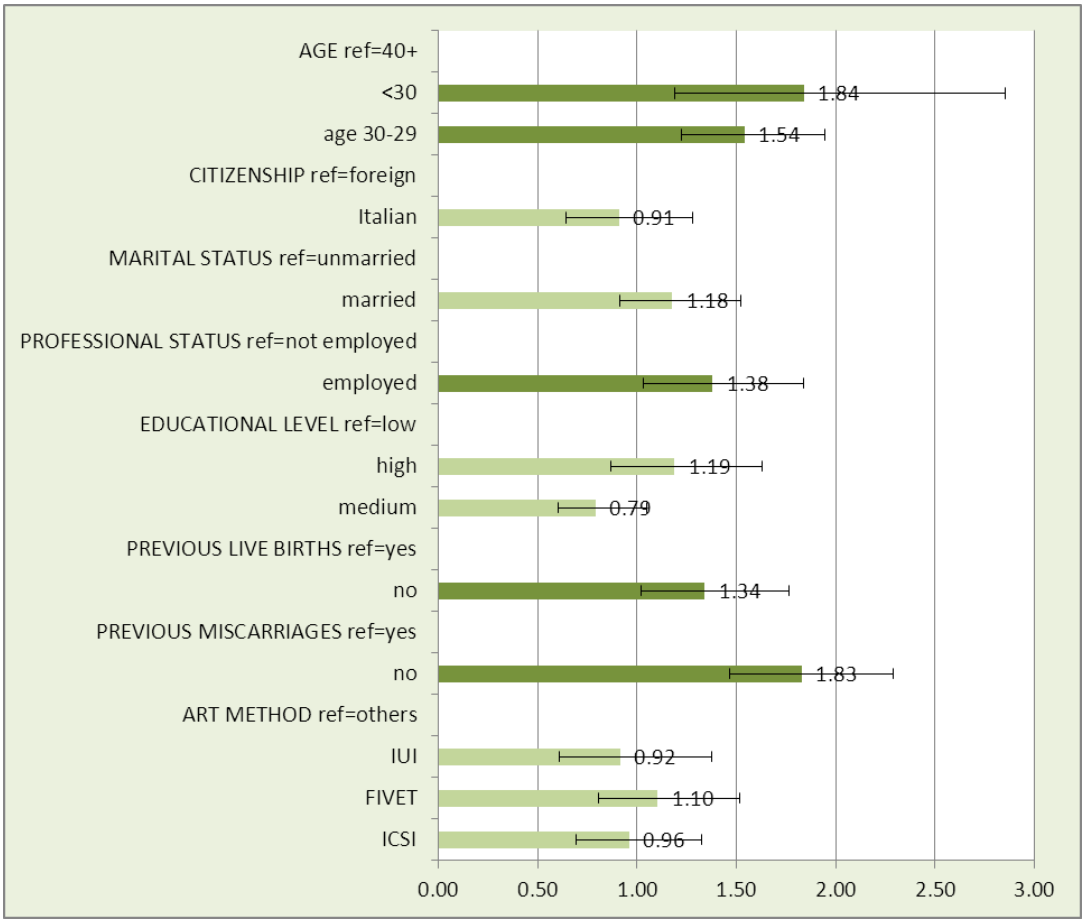


b. Pregnancies and delivery characteristics

The study carried out on both data source (CEDAP and AS) allows to verify what are the characteristics most influencing the probability to have a live birth versus an adverse outcome (miscarriage or stillbirth) after a fecundation by ART.

Results from only five regions, (namely Piemonte, Lombardia, Trentino-Alto Adige, Emilia-Romagna, Toscana) shows that among pregnancies terminated with a live birth or an adverse outcome there are no statistically significant differences in the ART method used (Fig. 5). A younger age is a major factor of success, as well as being employed. Surprisingly there is no significant effect of education level neither of citizenship nor of marital status. The fact of having a first birth and not to have experienced previous miscarriages increase remarkably the likelihood of having a birth and not an adverse outcome.

Fig. 5 Results of a logit model contrasting the characteristics of pregnancies and deliveries obtained by ART treatments versus those who did not. Odds ratios



d.Future analysis

In the following analysis we will contrast the probability of having a life births versus an adverse outcome, contrasting those who uses ART and those who did not. Moreover also other adverse outcome will be analysed, such as low weight at birth and the presence of malformations.

Conclusion, the implications of ART diffusion on fertility pattern and on health system will be also discussed.