# 'Be the match'. Predictors of decisions concerning registration in potential bone marrow donor registry in a group of Polish young adults as an example of prosocial behaviour

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## Abstract

Most of the studies about donation decisions focus on some personality factors, self-esteem or some family characteristics as separate sources of influence and do not take into account interdependence of these variables. The study attempts to conceptualize and validate an integrative framework, based on SCT A. Bandura, incorporating personal, environmental and behavioural determinants of the decision to register as a potential bone marrow donor. The study hypothesizes and tests the interdependent variables model of personality traits, self-esteem, practical past prosocial behaviours and family functionality as the key determinants of the decision of registration as potential bone marrow donor (PBMD) on the sample of 305 Polish young adults aged 18–25 years. The study was conducted using Polish versions of the following questionnaires: TIPI by Gosling et al. for measurement of the Big Five personality traits, Rosenberg Self-Esteem Scale (SES), PBQ (based on the Self-Report Altruism Scale by Rushton) by Moroń, and Family Apgar scale by Smilkstein for assessing family function. The results obtained due to using a hybrid data-mining' techniques LR and CART, allow the formulation of predictive equations defining the probability of making the decision to register as a potential bone marrow donor as a result of personality traits of agreeableness, conscientiousness, and self-esteem, as well as positive affect in family modelling and adaptation. However, the negative role of past prosocial behaviours, also demonstrated in research, requires further explanations. Although these methods may supplement the existing statistical models and contribute to the interpretation of factors of decision concerning the registration as a PBMD, further testing of the model according to the investigated variables requires the use of casual modelling methods in order to verify hypotheses concerning the occurrence of a specified structure of relationships between these variables.

**Keywords** Prosocial behaviour · Potential bone marrow donors · Living altruistic donation · Regression analysis · Classification and regression tree

## Introduction

The Bone Marrow Donors Worldwide (BMDW) data indicate that approximately 30 million people worldwide are registered, including 1.5 million Poles, which makes Poland the second largest register of potential donors in Europe and the fourth worldwide (https://www.dkms.pl/pl). The Polish Ministry of Health emphasizes that the resources of the Polish register stand out on the European background

considering the young age of potential donors. As many as 40% of them are under 30 years of age, while the subsequent 37% are between the ages of 30 and 40. However, it is worth mentioning that the members of the registers constitute less than 4% of Polish society (https://www.populationof.net/pl/poland/), whereas, e.g. in Germany, more than 10% of the population declared their wish to donate (https://www.zkrd.de/en/about_the_zkrd/the_zkrd.php). This suggests that Polish society seems to be in need of further incentives to declare honorary donation and develop even more effective methods of recruitment for registers; therefore, further studies in this area are necessary.

Actions for the sake of the environment oriented towards optimization of the functioning, protection and development of others, but also of institutions, groups, societies, ideas and organizations, are defined as prosocial, because due to these actions social interests are pursued. Undoubtedly, an action

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such as readiness for organ donation may be understood as a typical prosocial behaviour, increasing opportunities to help others in a difficult life situation which is illness. There is a chronic and largely insatiable demand for organ transplants. The demand for stem cells, organ or tissue donors has risen as there is greater improvement in transplantation outcome. Unfortunately, the number of people needing transplants far surpasses the number willing to donate. Low deceased donation organ rates worldwide have resulted in an increasing reliance on the supply of organs from living donors who are either genetically or emotionally related (i.e. relative or spouse) or unknown (i.e. stranger) to the recipient (Hyde and White 2009a). At present, transplants from unrelated donors constitute the majority of this type of allogeneic procedures. Thus, for many years, the problem of organ donation (so-called *living altruistic donation - LAD*), shaping positive attitudes towards donation, and studies of the factors which may exert an effect on decisions concerning the expression of consent for donating such a gift to those in need, has been raised in many countries worldwide, because it constitutes a great social value. The study focuses on the form of donation action (or rather, readiness to undertake these actions) which is a declaration to become a bone marrow and/or peripheral blood haematopoietic stem cells donor, expressed by joining the register of prospective potential donors. In a later part of the study the persons who made such a declaration concerning a donation will be briefly coded as PBMD (Potential Bone Marrow Donors), whereas those who did not make such a declaration as Non-PBMD.

Can the decision about registration as PBMD[1] be called a 'prosocial behaviour', or more strongly 'altruistic'[2]? In the light of the definitions of both prosocial behaviour and altruism – definitely 'Yes'. Prosocial behaviour is a voluntary, purposeful activity to the benefit of another person. Such behaviour is considered as altruistic if it is motivated by genuine willingness to be a beneficiary without expecting any benefits for oneself (Gerrand 1994; Manni 1995; Miller 2002; Sells 2003; Sque et al. 2007; Costa et al. 2009; Quinn et al. 2013; Feigin et al. 2014). Altruistic behaviours typically improve the welfare of the recipient at the cost of the performer's resources and energy (Switzer et al. 1997; Hu et al. 2016). Altruism may also be defined as a unselfish behaviour, which brings advantage to someone else, irrespective whether the cost is higher than the benefit for the well-doer who is motivated by concern for the well-being of others, or intrinsic values and goals not expecting any material or social rewards or to escape punishment (Bergstrom et al. 2009; Singer 2015; Hartmann et al. 2017; Kraut 2018). Prosocial behaviours are actions aimed primarily at bringing benefit to others, and joining the registry

of potential donors, as the registries themselves may be called public goods used by all, increasing the probability of finding a donor when needed (Bergstrom et al. 2009). This decision evidences willingness for generous behaviour. Those who join the bone marrow donor register are provided with clear information concerning possible inconveniences related with their decision (when, e.g. there occurs the situation of donation), they know possible risks, inconveniences and discomfort, they know that they will not obtain any material gratification, and the recipient almost certainly will be anonymous. The 'costs' for a potential donor are numerous, and range from low to high (Bagozzi et al. 2001; Pulsipher et al. 2009, 2014; Miller et al. 2009); however, millions of people worldwide have voluntarily joined the registries. Why have they done so? (Popp et al. 2006; Bergstrom et al. 2009). In addition, it is worthwhile posing the question what one should do in order that others would follow suit, because such decisions are important from the point of view of benefit for the whole human community. Each organ or tissue transplantation *has its source in the decision of great ethical value to unselfishly offer a part of one's own body with a view to benefit the health and wellbeing of another person. This consists in donating organs or tissues to someone else, which places the donor within the scope of widely understood* prosocial behaviours, because these behaviours are voluntary, aimed at benefiting the environment, and are related with actual unselfish actions to the advantage of others, and being an end in itself (Bar-Tal 1976; Rushton 1980).

In order to understand the sources of prosocial behaviours, the Social Cognitive Theory (SCT) by A. Bandura was used as a theoretical basis. Bandura (1986, 1998) believes that the domains of person, environment, and behaviour interact in a reciprocal manner to influence current and future behaviour. Bandura's SCT concept is one of the theories in this field, based on which altruism is rooted in past learning and the processes of reinforcement, punishment, and also observing patterns involved in altruistic behaviours. The author assumes after Bandura that prosocial behaviours in adolescents, such as, willingness to share with others, most often unknown persons, own tissues, are the effect of trilateral impact – person-related, environmental and behavioural. SCT constitutes a perspective from which the facts described in the study are seen, developing a study model (operationalized after performing analysis of the available literature). Tested constructs are viewed as complementary to those found in SCT.

The literature addresses a plethora of variables influencing whether individuals will become donors. Only a few studies could be found examining the decision-making processes behind bone marrow donation (Bagozzi et al. 2001). Studies of predictive factors of making the decision to donate and readiness to donate are divided into several groups. These are studies of the following factors: socio-demographic (attitudes towards donation, as well as a socio-demographic profile of

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[1] In BMDW via Central Registry of Unrelated Potential Marrow Donors and Umbilical Cord Blood, DKMS Poland, etc.

[2] Titmuss' idea of donation as a gift (1970).

the potential donor), personality (including mainly seeking the constellation of personality traits which lead to prosocial or altruistic behaviours, and self-esteem), and environmental, including primarily aspects of family functioning (the structure of a family system, family communication messages concerning donation, and transmission of attitudes).

**Person-Related Determinants** Attitudes towards helping others, knowledge concerning transplantology, financial benefits, and acquaintance with other donors (Lee and Kissner 1986; Perkins 1987; Nolan and Spanos 1989; Besser et al. 2004; Vasconellos et al. 2011; Narang 2018) are the factors/ variables which were related with the actual fact of possessing a donor's card and willingness to potentially sign such a card. Studies showed that living altruistic donors of blood, tissue, etc. tend to be better educated, less conservative, less religious, and present a more positive attitude towards science than nondonors; and that the percentage of donors was higher among females (Cleveland and Johnson 1970; Cleveland 1975; Conesa et al. 2003; Gibek et al. 2017), although the results of studies pertaining to the effect of gender are inconsistent (Mortelmans et al. 2008). Other studies confirmed that donors are most often relatively young persons, under the age of 40, with a higher socio-economic status than non-donors, with no differences observed between genders (Amir and Haskell 1997).

**Personality** Mixed linear model association analysis (MLMA) performed on aggregated data from 15 items, which constitute nearly 2500 individual observations, shows that the traits of the Big Five, such as agreeableness and openness to experience are significantly and positively related with prosocial behaviour, whereas none of the three remaining traits are so related (Kline et al. 2017). Another study demonstrated that agreeableness was the measure of personality most closely associated with positive emotional reactions to the victims in need of assistance, and with later decisions of providing assistance to these persons (Habashi et al. 2016). Also in the study of prosocial behaviours in economic games, agreeableness was unequivocally and significantly associated with prosociality (Zhao et al. 2016). Nevertheless, it was observed that conscientiousness, and neuroticism are inversely related with donations (both time and money which the respondents were ready to devote), while openness to experience shows the highest positive relationship with donations to charities and the number of hours devoted to charity work (Brown and Taylor 2015). The so-called 'prosocial personality' is even considered by researchers as a form in which agreeableness is manifested (Graziano and Eisenberg 1997; Habashi et al. 2016).

Each of the Big Five domains can differ according to different research domains. Bekkers (2006) indicated that blood and organ donation were positively correlated with Agreeableness, whereas charity was positively associated

with Openness and Extraversion. The study by Bolt et al. (2011) and Demir and Kumkale (2013) confirmed the relationship between the decision about donation of the body after death with agreeableness and conscientiousness; however, Bolt et al. did not prove such a relationship among the elderly (2011), which suggests a greater readiness for such behaviours in young persons. No other personality dimensions were predictive of organ donation outcomes, for example, conscientiousness. According to Hill's (2016) opinion, the lack of influence of conscientiousness in organ donation merits examination. Wildman and Hollingsworth (2009) in their study of blood donors did not find any empirical evidence of 'pure altruism', and concluded that donation appears to be more of a consequence of social norms and societal embeddedness (Paraskevaidis and Andriotis 2017). Similarly, not all studies (McIntyre et al. 1987; Nolan and Spanos 1989) confirm the role of elevated empathy in persons declaring willingness for honorary donation. Also, Hyde and White (2009b, 2010) emphasized rather the role of behavioural and normative (therefore learned) beliefs in making the decision about donation. This transfers the interest in donation to the area of suprapersonal factors.

**Self-Esteem** In studies, prosocial behaviours are also connected with self-esteem (Rudestam et al. 1971; Driver 1987; Afolabi 2014). Prosocial behaviour is theoretically and empirically related with self-esteem in the childhood and the period of adolescence (Afolabi 2014). Some researchers presumed that self-esteem and prosocial behaviours are related to one another in a bidirectional, thus reciprocal way (Eisenberg and Fabes 1998). This would mean that prosocial behaviours could allow an individual to improve self-esteem, while, in turn, an enhanced self-esteem would cause an upward tendency toward prosocial behaviours (a positive feedback loop). However, the studies are equivocal in various age groups. The researchers stated that there is a moderate relationship between self-esteem and prosocial behaviour in children attending primary school (Larrieu and Mussen, 1986), but there is a lack of studies among adolscents (Eisenberg and Fabes 1998). While interpreting the relationship between self-esteem and prosocial behaviours, the researchers emphasized that the opportunity for gaining greater respect in the environment may motivate individuals for charity and philanthropy (Mathur 1996). Haggberg (1992) suggested that by donating (to charity), people may feel more appreciated or recognized. Hessing and Elffers (1986) found that in persons with low self-esteem the signing of a donor's card created an opportunity to improve self-esteem. Wu et al. (2013) also suggested that high self-esteem is a pioneering factor for the decision about donation. The possible provision of help to another person also depends on the present mood of an individual, according to the principle 'you feel well, you do well' (Berkowitz 1987; Forgas and Bower 1987; Carlson et al.

1988; Salovey et al. 1991; Schwartz et al. 2012), thus, e.g., on high self-esteem. Another explanation of the relationship is using prosocial behaviours in order to increase the sense of self-esteem, and consequently improve self-esteem (Wymer 1997; Musick and Wilson 2003; Mueller et al. 2008; Haski-Leventhal 2009; Weinstein and Ryan 2010). Thus, in the study by Cohen and Hoffner (2013), young donors declared that due to their decision they experienced a specific emotional benefit in the form of satisfaction and pride. Nevertheless, there are studies in which young respondents could not define the reasons for their decision Yes or No, in this way hindering the psychological interpretation of the psychological factors of a decision or its lack (Feeley et al. 2014).

**Family Studies** Organ donation research has centered on improving donation rates rather than focusing on psychological aspects of LAD families functioning. Family studies mostly refer to understanding the predictors of the consent rate of families (*post-mortem* organ donation of relatives) for donation, and family barriers to obtaining family consent for potential organ donation. Most existing research on the experiences of donor families has focused of the factors influencing bereaved families' decisions to agree or decline the donation of their deceased relative's organs for transplantation (Martinez et al. 2001; Brown et al. 2010; Hyde and White 2010; Walker et al. 2013; Xie et al. 2013; Ebadat et al. 2014; Dicks et al. 2017; Luberda and Cleaver 2017; López et al. 2018; Miller and Breakwell 2018), with only few studies pertaining specifically to the family determinants of decision of organ or tissue donation from living donors. To-date, in the studies of persons expressing readiness for helping others (PBMD), mainly the structural family predictive factors were tested as number of siblings; whether the oldest, the youngest, etc., gender, the order between the siblings; if the mother works inside or outside the home; and whether living with both parents (Ruiz-Olivares et al. 2013; Sanadhya et al. 2010). A positive effect of provision of information concerning donation in the family was also observed (Nolan and Spanos 1989; Smith et al. 2004; Galanis et al. 2008; Murray et al. 2013). However, this concerns the content of the information provided and not communication patterns; therefore, what is communicated or not and in what way. Nevertheless, there is a lack of studies of the functional psychological factors (relations, communication patterns, etc.). Family functionality is the extent to which family patterns are effective and useful in achieving cordial relationship and prosocial behaviours of family members. A special role of communicating family emotions (affective family relations) may confirm that prosocial behaviours are generated due to manipulation of the affective environment during the development of an individual (Mac Donald 1984; Smith 1988; Okeafor and Chukwujekwu 2017; Booysen et al. 2018), and subsequently, repeating behaviours of this type in the

situations of daily life. Other researchers identified regular blood donation, having a relative or a friend who has already been registered as PBMD, having a relative or a friend who needs bone marrow transplantation, family discussions about donation, knowledge about bone marrow transplantation, and trust in health professionals or staying in partnerships, as predictive factors of the decision to register as PBMD (Nolan and Spanos 1989; Galanis et al. 2008; Sikora et al. 2014; Li et al. 2018). The scope of problems concerning family donor transplantations has also been undertaken - evolutionary psychology suggests that prosocial/altruistic behaviour among family members is primarily the result of adaptation to family and reciprocal altruism, according to the degree of genetic relatedness and exchange of benefits (Webster 2003; Stewart-Williams 2007; Curry et al. 2013).

Although the procedure of registration is associated with a number of practical actions (collection of information materials,[3] collection of a sample of genetic material, sending to the register, etc.); nevertheless, it does not require the undertaking of rapid actual actions in the form of undergoing the procedure of collection of biological material. Every year, it occurs that even in situations when histocompatibility[4] is confirmed, a part of the potential donors withdraw from their decision, and the act of donation does not take place. "*Joining the registry is painless and takes little time. Making a donation is a more serious matter*" (Bergstrom et al., 2009, p. 3). Thus, it should be noted that studies of people who signed the registers of potential bone marrow donors are basically the studies of persons expressing their readiness for prosocial behaviours in a specific life situation (i.e. in the situation of a disease with a potentially fatal course concerning a person who is most often anonymous for the donor), but not studies of direct behavioural donation acts.

Summing-up the review of studies, it may be presumed that they present various approaches, both substantial and methodological. These studies concern very different groups of donors and potential donors (and it is relatively difficult to transfer their results to donors of another type), they generally focus on one area, which justifies the selection of the research problem undertaken and the method of its investigation. Also, one should be cautious while transferring results obtained in the groups of persons who had committed donation acts onto the groups of potential donors, especially that also in this area the declaration of donation is divided into *post-mortem* and living organ donation. The majority of studies focus on the scope of problems concerning *post-mortem* donation, whereas considerably fewer studies were conducted pertaining to living (including also potential) donation. Particularly from non-westernized countries there is limited literature examining registration as a donor (i.e. PBMD), therefore research in these

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[3] Unless the decision was made during propagating collective action encountered, e.g., at universities, or in other institutions.

[4] Histocompatibility within the HLA system, i.e., immune system proteins.

regions is needed (Ab Latiff et al. 2016). The study focused on individuals who declared the decision to help an unknown ill person in the form of donating own tissues to this person, and not on actual donors treating the decision as an expression of readiness for prosocial behaviour (important from the aspect of social good). Using the data from met analysis of literature, a wide spectrum of predictive factors of the decision to register as PBMD was considered, such as: personality, self-esteem, family functioning, and prosocial behaviours.

## Method

### Participants

A sample of Polish young adults ($N = 234$, 193 females and 112 males) aged 18–25 years (M = 22.36 years, SD = 2.01 years) participated in the study. Data were collected using 4 structured questionnaires and 1 demographic survey (Table 1), during 15 days of a research project on Facebook. Participants did not receive any financial incentive to participate. The only selection method used was participants' age (18–25); 5 participants were excluded for incomplete data.

**PBMD Group** No significant differences were observed between males and females according to age (U = 436.5; $p = .073$). As many as 64.8% of respondents in this group

$(n = 46)$ graduated from university or continued study, followed by 35.2% ($n = 25$) who completed secondary school. The majority of respondents grew up in a complete family – 74.6% ($n = 53$), while 25.4% of them came from incomplete or broken families (n = 18). The majority of respondents had siblings – 83.1% ($n = 59$), while 16.9% ($n = 12$) were only children. The majority of the PBMD evaluated their income as mediocre – 52.1% ($n = 37$), 32.4% ($n = 23$) as poor, whereas 15.5% ($n = 11$) as good. *Non-PBMD*. The examined males were significantly older than females (U = 5199.5, $p = .018$). As many as 59.4%, ($n = 139$) of respondents graduated from university or continued study, 34.2% ($n = 80$) completed secondary school, and 6.4% ($n = 15$) – primary school. The majority of respondents came from complete families – 76.9% ($n = 180$), while 23.1% ($n = 54$) - from incomplete families. Most of them had siblings – 79.1% ($n = 185$), whereas 20.9% ($n = 49$) were only children. The respondents most frequently evaluated their income as mediocre – 47.9% ($n = 112$), followed by 29.1% ($n = 68$) – as poor, and 23.1% (n = 54) as good.

In both groups, the percentage of females was considerably higher than that of males (PBMD - $n_M = 36.6\%$ [$n = 26$] and $n_W = 63.4\%$ [$n = 45$]; non-PBMD - $n_M = 36.8\%$ [$n = 86$]; $n_W = 63.2\%$ [$n = 148$]). The proportions in the groups were similar, with a lack of significant differences between them ($\chi2 = .000$, $p = .984$). No differences between the study groups were found according to age (U = 8186.5, $p = .851$). Also, no differences were observed between the study groups

**Table 1** Basic demographic characteristics of the participants

| Characteristics | $N = 305$ | | p |
|---|---|---|---|
| Decision about registration (yes – no) | Yes (PBMD) $n = 71$ (23.3%) | No (Non-PBMD) $n = 234$ (76.7%) | |
| Gender | $n_M = 26$ (36.6%) | $n_M = 86$ (36.8%) | .984 |
| | $n_W = 45$ (63.4%) | $n_W = 148$ (63.2%) | |
| Age in years | M = 22.37; SD = 1.914 | M = 22.36; SD = 2.063 | .851 |
| | $M_M = 22.88$; SD = 1.904 | $M_M = 22.74$; SD = 2.065 | |
| | $M_W = 22.07$; SD = 1.876 | $M_W = 22.13$; SD = 1.995 | |
| p | .073 | .018 | |
| Level of education | | | |
| Primary | 0 (0.0%) | 15 (6.4%) | .089 |
| Secondary | 25 (35.2%) | 80 (34.2%) | |
| College/studying | 46 (64.8%) | 139 (59.4%) | |
| Family structure | | | |
| Two-parent (complete) | 53 (74.6%) | 180 (76.9%) | .693 |
| One-parent (incomplete or broken) | 18 (25.4%) | 54 (23.1%) | |
| Siblings | | | |
| Yes | 59 (83.1%) | 185 (79.1%) | .456 |
| No | 12 (16.9%) | 49 (20.9%) | |
| Material standard | | | |
| Good | 11 (15.5%) | 54 (23.1%) | .392 |
| Mediocre | 37 (52.1%) | 112 (47.9%) | |
| Poor | 23 (32.4%) | 68 (29.1%) | |

according to education level ($\chi2 = 4.828$, $p = .089$). There were no differences between the PBMD and non-PBMD groups, according to the proportions of complete and incomplete families ($\chi2 = .156$; $p = .693$), and possessing or not possessing siblings ($\chi2 = .555$, $p = .456$). No significant differences were noted between the proportions of evaluation of material standard ($\chi2 = 1.874$, $p = .392$).

## Materials

**Ten-Item Personality Inventory** (TIPI; Gosling et al. 2003; TIPI-PL; Sorokowska et al. 2014) is the most popular, short method used to measure personality defined as the "Big Five" - Neuroticism, Extraversion, Conscientiousness, Openness to Experience and Agreeableness. It consists of 5 diagnostic domains, which allow determination of the level of intensity of individual traits of the Big Five. The respondent's task is to indicate, according to the 7-point Likert scale (*strongly disagree* – 1, *strongly agree* - 7), the degree to which he/she agrees with each of these statements; the higher the result, the greater the intensity of an individual trait. The result of adaptation efforts in a group of 1772 Polish students is the development of TIPI-PL in two versions – paper-and-pencil and Internet. Studies showed satisfactory reliability of the TIPI-PL scales. The values of coherence coefficients (Cronbach $\alpha$) in all forms of the questionnaire demonstrate that TIPI-PL scales are characterized by a close or higher reliability, compared to the original version of the scales. In addition, both in the case of inventory of the type paper-and-pencil, and the Internet questionnaire, the test-retest correlation for all subscales was very high. Moreover, equivalence of the Polish version by Sorokowska et al. (2014) of the test in the form of a classic questionnaire of the paper-and-pencil type and the Internet version was verified. For the paper-and-pencil version of the questionnaire, Cronbach $\alpha$ ranged between .44 (Openness to Experience) and .75 (Conscientiousness), whereas for the Internet versions they ranged between .45 (Openness to Experience) and .83 (Neuroticism); test-retest reliability ranged between .56 for Openness to Experience and 0.83 (Neuroticism and Conscientiousness). Corvengent validity was confirmed by establishing correlation with the results of NEO-FFI ($r_{mean} = .65$). Additionally, paper-and-pencil and Internet versions of the questionnaire were equivalent (Sorokowska et al. 2014).

**Self-Esteem Scale** (SES; Rosenberg 1965) is a unidimensional measure allowing the assessment of the level of general self-esteem – or a constant disposition understood as a conscious attitude (positive or negative) towards the self. It consists of 10 diagnostic statements. The respondent's task is to indicate, according to the 4-point Likert scale (*never* – 1, *very often* - 4), to what degree he/she agrees with each of these statements; the higher the result (10–40 scores), the higher the respondent's self-esteem. The Polish instrument is characterized by a high internal consistency of the majority of the scales (Cronbach $\alpha$ coefficients for various age groups range from .81–.83). The indicator of stability of the instrument – assessed by the test-retest method - was .50 (measurements performed with an interval of 1 year) and .83 (measurements performed with an interval of 1 week). The value of Cronbach $\alpha$ reliability coefficient in the Polish version of the method for the group of 452 students aged 19–24 was 0.83. Analysis of Guttman split-half coefficient determining split-half reliability was satisfactory (.75), similar to split-half correlation (0.62). Both EFA (by the method of principal components with Oblimin rotation and Kaiser normalization, which confirmed the assumed factor structure of the scale), and CFA in the course of analyses of verified structural models ($N = 561$, fit indices[5]: CFI = 0.99; $\chi2 = 20.92$, df = 16, $p = 0.18$; RMSEA = 0.02), confirmed the validity of the method. It was also confirmed that the instrument possesses satisfactory factor, convergent and discriminant validity. The results obtained evidence the validity of the Polish version of the SES and its high reliability, which allows consideration that it possesses satisfactory psychometric properties (Łaguna et al. 2007; Dzwonkowska et al. 2008).

**Family Apgar** Smilkstein (1978) predicted the use of this questionnaire for both the assessment of the family situation as a whole, and also the evaluation of relationships with a spouse or other significant person, with a parent or parents, and a child and children. The questionnaire consists of 5 items. The replies are provided according to the 3-point Likert scale (*hardly ever* - 0, *almost always* - 2); the higher the result, the greater the intensity of the investigated characteristics of the family system. The test enables the assessment of family function in 5 domains: adaptation – the utilization of intra- and extrafamilial resources for problem solving in stressful and crisis situations; partnership – sharing of decision making and taking responsibility for them by all family members; growth – physical and emotional self-fulfillment achieved due to mutual support and assistance; affection – loving and caring relationship and showing love and care; resolve – commitment and devoting time to other family members. The original version of Family Apgar possesses satisfactory psychometric indicators – Cronbach $\alpha$ coefficient for individual subscales and the total result remain within the range .80–.85 (Smilkstein et al. 1982); whereas in the latest studies – within the range from .73–.78 (Gardner et al. 2001; da Silva et al. 2014). Also, the validity of the original version of Family Apgar did not evoke reservations (Smilkstein et al. 1982). In the process of adaptation of the Polish

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[5] CFI – Comparative Fit Index; RMSEA – Root Mean Square Error of Approximation

version by Szałachowski ([2019](#)), a study was conducted in a group of 312 respondents. Cronbach's α reliability coefficient for the general result was .78, and for individual subscales - .72–.76. The result of CFA analysis ($N = 212$, fit indices: CFI = 0.996; χ2 = 5.954, df = 5, $p = 0.311$; RMSEA = 0.03), concerning the validity of the method, evidences good fit between the hypothetical model and the input data (Szałachowski [2019](#)).

**Prosocial Behaviours Questionnaire** (PBQ; Moroń [2012](#)) was based on one of the popular methods for investigating the tendencies toward prosocial behaviours - Self Reported Altruism (SRA) Rushton et al. ([1981](#)), in which the examined person determines the frequency of undertaking specified prosocial behaviours in own life. In the cultural adaptation, the results of the report were considered concerning charitability of Poles[6] (Raport Ecco [2010](#)), taking into account the specificity of Polish forms of philanthropic and charity activities. With the use of competent judges (content verification) from the initial 70 statements, a set of 20 statements was developed, which were included in the final version of the questionnaire. The respondents define the frequency of their behaviours according to the 5-point Likert scale (*never* - 0, *very often* - 4); the higher the result, the greater the intensity of the investigated behaviours. The content validity ratio (CVR) was calculated, which was one of the criteria for the assessment of content validity. All items which passed the preliminary selection based on a number of criteria obtained from evaluations by competent judges and replies provided by participants ($n = 188$) of the pilot study (item-total correlation: r > .40; discriminating power of item: rbi > .50) and CVR > .50 were qualified for further analyses. In this way, the final version of the Polish version of the questionnaire was developed, considering 3 scales, distinguished by means of factor analysis, obtaining acceptable values (.412–.769), and characterized by sufficient reliability philanthropic and charity behaviours (donating money and articles, i.e. food, clothes, etc., Cronbach α = .83, $W_{Shapiro–Wilk} = .988$, $p > .05$), active prosocial behaviours (voluntary work for others, Cronbach α = .76, $W_{Shapiro–Wilk} = .882$, $p < .01$) and supporting prosocial behaviours (supporting others, Cronbach α = .72, $W_{Shapiro–Wilk} = .99$, p > .05). The general indicator of prosocial tendencies obtained satisfactory reliability (Cronbach α = .88, $p < .05$), and its distribution was normal ($W_{Shapiro–Wilk} = .987$, p > .05), which confirms proper reliability of the PBQ for group studies (Moroń [2012](#)).

The decision to use this type of instruments was made bearing in mind the increasingly visible tendency to use shorter measures in scientific research (Gosling et al. [2003](#); Credé et al. [2012](#)). These widely-used instruments were selected for their strong psychometric properties as well as their well-supported use in adolescent and young adults research. All the instruments used had satisfactory, empirically proved psychometric properties (delVecchio Good et al. [1979](#); Smilkstein et al. [1982](#); Dzwonkowska et al. [2008](#); Moroń [2012](#); Castilla et al. [2014](#); da Silva et al. [2014](#); Sorokowska et al. [2014](#); Szałachowski [2019](#)). In addition, the respondents were asked a question concerning the fact of registration as PBMD (together with all the necessary examination procedures[7]).

## Design

Participants were recruited to take part in a research project 'In what ways is goodness manifested? Psychological aspects of tissue and organ donation' via Facebook.[8] The project was designed according to methodological guidance to provide immediate and irreversible anonymity, secure storage of the data and abstinence from any communication or interaction with the individuals in the sample, and caution not to reveal any information that could be attributed to a single individual (Kosinsky et al. [2016](#)). This has some limitations, but from a methodological perspective, however, the Internet has the potential to additionally be an asset as a research tool, a method in the social sciences and thus, for example, a gateway to the analysis of cultural characteristics (Kissau [2009](#)). Given the relative dearth of comprehensive studies on this topic, the presented study intends to expand the understanding of the prosocial behaviour of young people, on the example of the decision to register as PBMD.

Based on the reviewed literature and the purpose of this study highlighted above (Fig. [1](#)), the following induction hypothesis is stated and tested: personality traits as agreeableness, consciousness and openness to experience, self-esteem and family functionality elements (adaptation, partnership, growth, affection and resolve), combined with prosocial behaviours (philanthropic and charity behaviours, active prosocial behaviours and supporting prosocial behaviours) predict the decision of young adults to register

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[6] For example, in cultural adaptation, the form of charity actions characteristic of Poland was considered – the 'Great Orchestra of Christmas Charity' – an annual charity action present in the national consciousness of Poles, similar to the Salvation Army in many other countries.

[7] The most frequent procedure concerns the registration in the DKMS Foundation Poland. In order to register, the registration package should be ordered on-line, or taken in the Foundation agency (or a specialist centre), a smear should then be taken and sent by post to its address (unless a recruitment field action is carried out). In each case, this means completing a number of definitive steps/actions, required for the purpose of registration.

[8] 'We strongly encourage our fellow social scientists to not only train themselves in modern computational methods, but to immerse themselves in new human environments, including Facebook' (Kosinsky et al. [2016](#), p. 75).

**Fig. 1** Research model - application of Bandura's Social Cognitive Theory model of triadic reciprocity
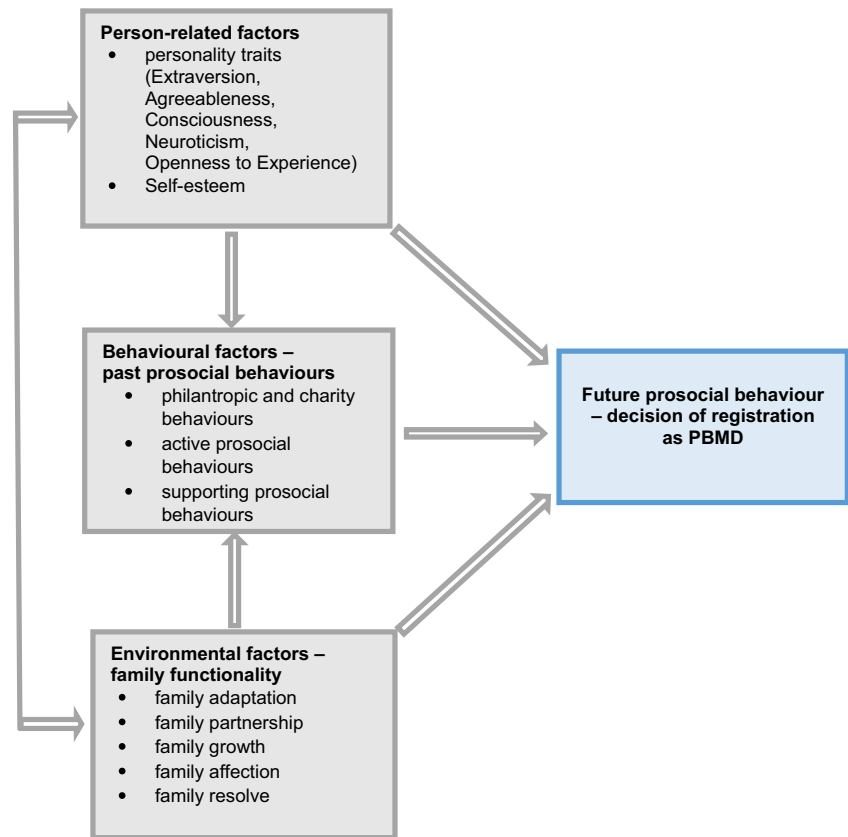


as PBMD. It should be noted that the presented study was aimed solely at predicting intentions (and not behaviour).

This is a descriptive and correlational study in which registration as PBMD is considered as a dependent variable, and personal factors - personality traits and self-esteem, environmental factors - family functioning, and behavioural factors - prosocial behaviours as independent variables and significant predictors. The main aim of the study was to identify the best predictors for the decision to register as PBMD, while taking into account the psychological factors drawn from the existing literature - roles of family functionality, assessed by the satisfaction with family function parameters (adaptation, partnership, growth, affection and resolve), personality traits (Big-Five: Extraversion, Conscientiousness, Openness to Experience, Agreeableness and Neuroticism), self-esteem and frequency of prosocial behaviours (philanthropic and charity behaviours, active prosocial behaviours and supporting prosocial behaviours), using the Logistic Regression (LR) and Classification and Regression Tree (CART) analysis. The goal of logistic regression used is to find the best fitting model to describe the relationship between the dichotomous characteristic of decision (dependent variable) and a set of independent (predictor) variables. The use of the multivariate CART technique should increase the power of data classification (i.e., into

'potential donors' and 'non-donors') and help obtain a reliable number of key significant decision-related statistics when using non-parametric data. Therefore, an attempt has been made to summarize an enlarged data set with the CART technique - a hierarchical, non-parametric method. CART analyses have been successfully employed in different branches of research, in which multiple variables obtained from individual subjects can be grouped together to improve classification into diagnostic or prognostic groups.

## Procedure

The research project 'In what ways is goodness manifested? Psychological aspects of tissue and organ donation' was presented in the event on the FB, leading to the link to an Internet set of studies, in which participation within 15 days was voluntary. The participants were asked to provide answers to the questionnaire in the same order as described in the study. The time of the study was not limited. The respondents were informed about the aim of the research. This procedure is acceptable with large research samples and multivariate analyses, as well as with specific study groups (Kissau 2009). This seemed to favour reliable performance of the tests, which is evidenced by the low number of uncompleted studies and rejected cases (and

additionally supplemented the image of persons interested in the scope of the problem of donation). The main argument in favour of conducting studies via the Internet, used by the majority of researchers, is also their satisfactory stability (Buchanan et al. 2005; Weigold et al. 2013).

## Analyses

The approach based on *hybrid data-mining* was adopted in the study. The proposed approach consists of 2 main procedures: due to the binary nature of the dependent variable, the first method of choice is LR analysis,[9] which allows determination of the variables significantly explaining the variability of the dependent variable, and subsequently, CART analysis, which enables optimization of the cut-off points for the independent variables into binary sets, maximizing the degree of explanation by a given independent variable of the degree of variability of the dependent variable (Knable et al. 2002; Li and Rapkin 2009). This method is used mainly in economic studies concerning purchase decisions, and recently in medical studies, for determination of the risk/probability of the ocurrence of specified behaviours, e.g., aggression or risky behaviours (Liu et al. 2011) and diseases (Segal 1995; Colombet et al. 2000), or other health-related behaviours (Lemon et al. 2003).

The CART method also seems to be an adequate method for tracing and an attempt to determine the variables associated with making the decision of registration in the bank of potential bone marrow donors.

The justification for the selection of the applied techniques of analysis were: 1) lack of theoretical data enabling the construction of a reliable model of the effect of the investigated variables, subjected to verification. In such a situation, the exploration-predictive model occurred to be the optimum choice, which is simultaneously a descriptive model allowing the description and presentation of the patterns in the examined population group; 2) complementarity of LR and CART – regression models focus on variables of a relatively high statistical significance, whereas decision trees do not optimize the adjustment of the model to the data, but in a sequential way divide the examined population into subgroups, based on the best prognostic variable. This allows identification of subgroups in the population predestined to the ocurrence of a specified event (Owczarek 2014). All statistical analyses were performed using the software STATISTICA and SPSS.

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[9] This statistical method is applied wherever the dependent variable is measured using the nominal scale, and assumes 2 values, coded as a lack or occurrence of a given phenomenon (Hosmer and Lemeshow 2000).

## Results

### Logistic Regression Analysis – Factors Predictive Values Testing

Satisfying the iterative convergence criterion, parameters with the highest reliability were determined (Table 2).

Based on the characteristics of the logistic regression equation, information was obtained concerning the level of the explained variance of the dependent variable of decision about registration as PBMD; the strength of the relationship was also determined between the selected set of predictive variables. Based on the value of the Wald test on the level of significance p = .05, it may be presumed that the decision about registration as PBMD significantly depended on: satisfactory family affection ($p = .008$); frequency of philanthropic and charitable behaviours ($p = .04$) and conscientiousness ($p = .05$). It is noteworthy that among predictors of decision the variable of conscientiousness and family affection increased the probability of making a decision to register as PBMD, while philanthropic and charitable actions decreased this probability.

### Decision-Related CART Results - Probabilities Estimation

CART analysis is a nonparametric decision tree methodology that has the ability to efficiently segment populations into meaningful subgroups. Described as flexible and easy to interpret, CART can supplement traditional analysis to analyse patterns of prosocial behaviours at an individual level, even for conditions with a low prevalence. Such a decision was made because the CART methods are a suitable alternative in the explanation of potentially complex interactions. The CART utilizes comprehensive computerized search and sorting techniques in order to identify useful structures of the tree for classification of data from several groups. In the case of the CRT technique, the classification of the variables classification potential is assessed with relation to the division of threshold value. A single best predictor (the one the optimum cut-off point of which maximizes the number of correct classifications among diagnostic categories) is selected as an initial variable on the top of the hierarchical tree. Objects with values lower than the cut-off point are transferred to one category, while those with values higher than the cut-off point are transferred to the other area of the hierarchical tree. The cut-off points are subsequently assessed step by step for the remaining predictors. A classification tree is generated which grows until the maximum classification is achieved, or further division is considered as cost ineffective, which means that the CART procedure provides a 'maximum tree' in which a maximum division of the diagnostic groups is achieved. The maximum tree is subsequently cut to an 'optimum tree', which is the best tree based on the accuracy of prognosticating. In other

**Table 2** Values of logistic regression coefficients obtained by logistic regression analysis using forward variable selection (df = 1)

| Variable | B | SEM | WALD | P | EXP(B) |
|---|---|---|---|---|---|
| Self-esteem | .006 | .036 | .033 | .857 | 1.006 |
| Extraversion | −.001 | .056 | .001 | .981 | .999 |
| Agreeableness | .031 | .058 | .289 | .591 | 1.032 |
| Conscientiousness | .094 | .049 | 3.665 | .05 | 1.099 |
| Neuroticism | −.092 | .054 | 2.902 | .088 | .912 |
| Openness to experience | −.107 | .064 | 2.818 | .093 | .898 |
| Family adaptation | .227 | .303 | .563 | .453 | 1.255 |
| Family partnership | .05 | .287 | .030 | .862 | 1.051 |
| Family growth | −.461 | .263 | 3.062 | .08 | .631 |
| Family affection | .820 | .309 | 7.060 | .008 | 2.271 |
| Family resolve | −.291 | .258 | 1.273 | .259 | .747 |
| Philanthropic and charitable behaviours | −.070 | .034 | 4.238 | .04 | .932 |
| Active proscial behaviours | −.074 | .04 | 3.452 | .063 | .929 |
| Prosocial support behaviours | .046 | .045 | 1.044 | .307 | 1.047 |
| Constant | 1.882 | 1.1 | 2.929 | .087 | 6.567 |

words, the variables are switched off when the 'cost' of addition of additional variables is high with respect to the number of additional correct classifications. Using the iterative algorithm, the respondents were qualified into increasingly more homogenous subgroups, with similar changes in the cognitive assessment profiles, allowing a more nuanced interpretation of the effect of various factors on the decision (Knable et al. 2002; Li and Rapkin 2009). It is interesting to see how the predictive power of these 2 methods (LR and CART) differ on a dataset.

CART was implemented at their best performance on the dataset and applied on the test set and compared to a logistic model. Within the CART analysis, an analysis was performed combined with the data from 2 diagnostic groups – registered as PBMD and non-PBMD. Here, the optimum tree was presented originating from these sets of data. The CART is presented graphically; the root node (undivided data) first branches into 2 descendent nodes according to the independent variables. Within each branch, the descending tree continues assessing the remaining independent variables to determine which variable results in the best split. This recursive partitioning continues until a termination criterion is reached. At the point where no further split can be made, a terminal node is established (Fig. 2). *Gini impurity* function was calculated as the measure of node 'purity'. The model reaches 79.7% of overall accuracy, with especially good accuracy for the category of non-donors (Table 3).

Analysis of the tree nodes leads to the selection of the most important predictors from the aspect of predicting the making of the decision concerning registration as PBMD: high frequency of active prosocial, as well as philanthropic and charitable activities, and a satisfying assessment of family affection which, to the highest degree, significantly increase the

probability of making the decision about registration as PBMD. Personality traits, such as agreeableness and conscientiousness, also contribute to the decision, significantly increasing the probability of making the decision.

Analysis of normalized validity of variables of the decision about registration as PBMD (Fig. 3) allowed the determination that among the investigated predictors of the decision about registration as PBMD, frequent philanthropic and charitable actions, and active prosocial behaviours play the greatest role, followed by personality traits, agreeableness, conscientiousness and self-esteem, as well as satisfying emotions (affection) and family adaptation.

Although the results of the LR and CART methods, and the application of normalization procedure did not provide identical results, they may be treated as complementary. Normalized values are the measure of statistical significance of a given predictor, while the position on the tree illustrates the moment (i.e., in this case – minimum value of intensity of the investigated variable), when a given predictor begins to work. Summing-up the results of LR and CART obtained, it

**Table 3** Overall accuracy of the model

| Observed | Predicted | | |
|---|---|---|---|
| | PBMD | Non-PBMD | Percent correct |
| PBMD | 22 | 49 | 31.0% |
| Non-PBMD | 13 | 221 | 94.4% |
| Overall Percentage | 11.5% | 88.5% | 79.7% |

Growing Method: CART
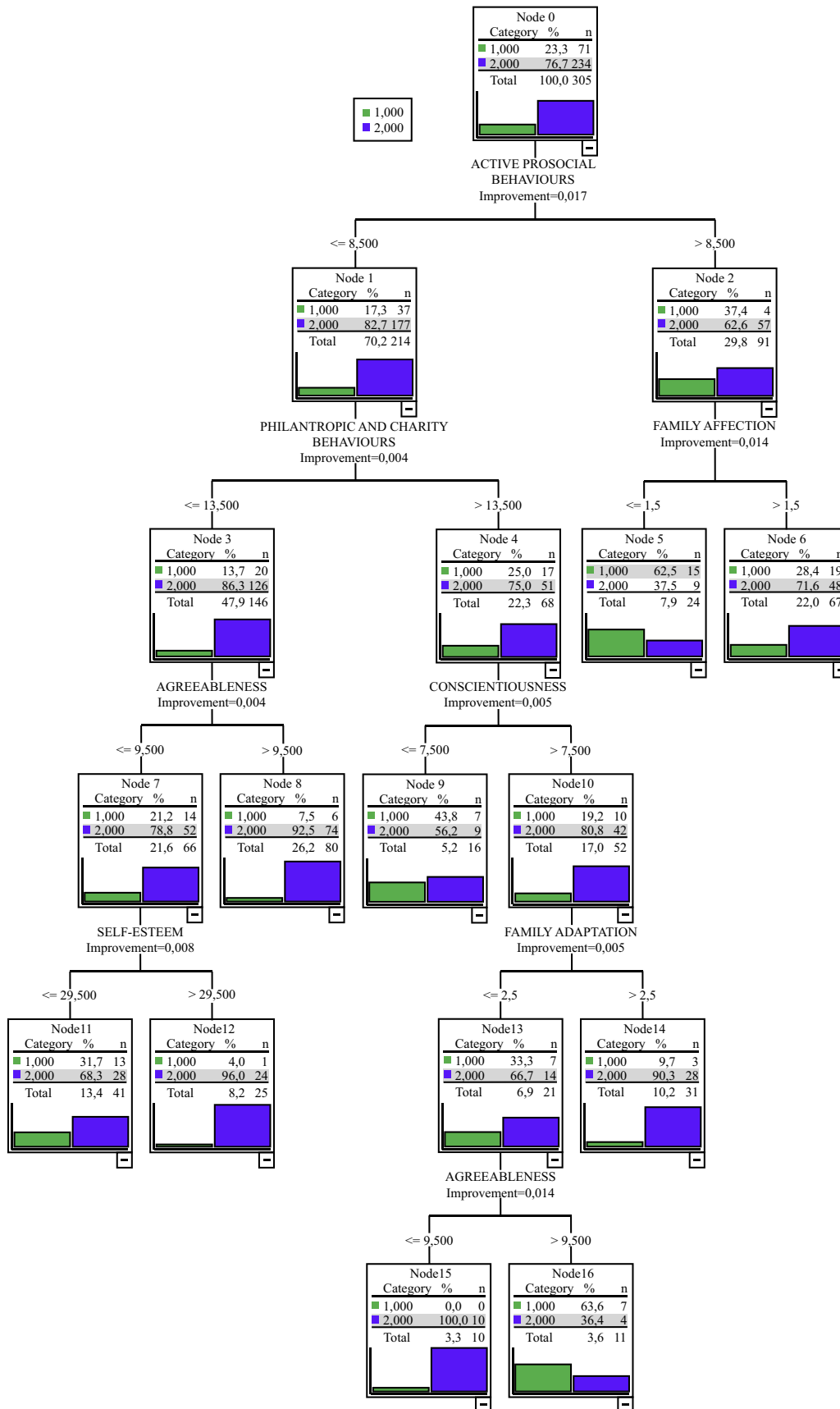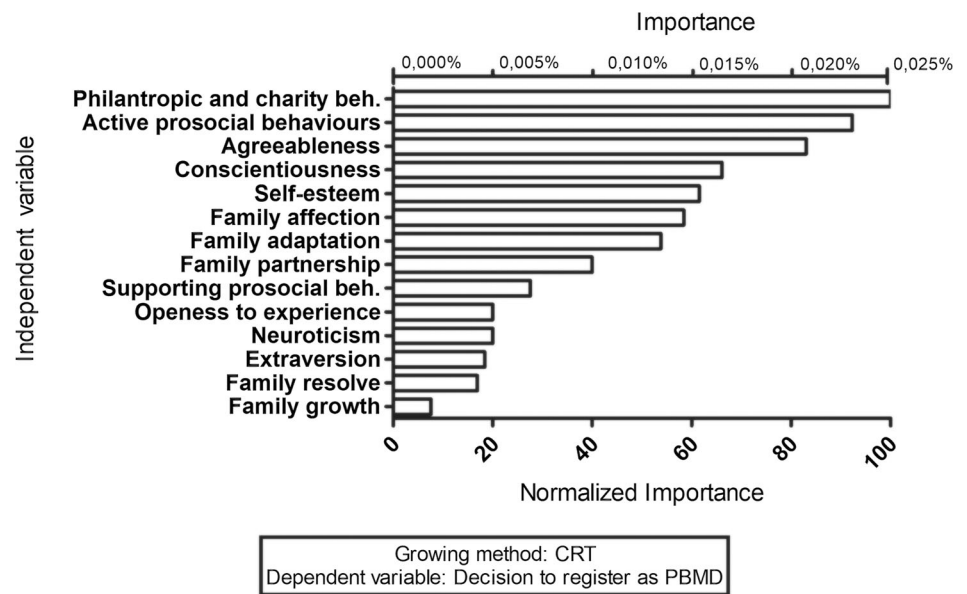
Dependent Variable: REGISTRATION AS PBMD

**Fig. 2** The model resulting from fitting a CART

**Fig. 3** Algorithm of construction of decision tree CART concerning registration as PBMD – variables ordered according to their normalized importance score for tree



may be presumed that CART also provided important data. Three of the factors observed with LR overlapped with the CART results. The CART method identified a larger set of factors that contributed maximally to the diagnostic classifications. Analysis indicated a basis for registration as PBMD in the examined group of Polish young adults – frequency of actual prosocial behaviours (consisting in the repetition of work activities of a voluntary character and spontaneous donation of money and other material goods to those in need), paving the way to a decision about registration. Personality traits, agreeableness, conscientiousness and self-esteem, also contribute to this decision, whereas among family variables, to the highest extent were satisfying affection and adaptation in the family. The results obtained allow the formulation of predictive equations (pioneering factors), determining the probability of making decision about inclusion in the donor registry. However, the character of relationships between the investigated variables requires ultimate explanation, especially the effect of past prosocial activity on making a decision to make a possible donation.

## Discussion

The hypothesis was tested whether such personality traits as agreeableness, consciousness and openness to experience, self-esteem and family functionality elements (adaptation, partnership, growth, affection and resolve) combined with prosocial behaviours (philanthropic and charity behaviours, active prosocial behaviours and supporting prosocial behaviours), predict the decision of young adults to register as PBMD .

**Prosocial Behaviours** It was found that prosocial behaviours in 2 forms – philanthropic and charitable, and active prosocial

actions, were most strongly related with decision predictor. Prosocial supporting actions were of considerably smaller importance. The results showed that the decision concerning registration as a PBMD was related with prosocial actions, but only with those of a directly active giving character (donating and volunteering), confirming their mediatory role for the decisions to donate. Nevertheless, it is important to determine in what way past prosocial behaviours (e.g. charitable and philanthropic) are related with the process of making a decision to register as PBMD (LR analysis shows that philanthropic and charitable behaviours significantly decrease the probability of making a decision to register). This factor is indicated among the most important predictors of the decision also by CART. Possibly, the decision to register or not is not related with past prosocial activity in a simple linear way, or it is related with it by a specific compensation 'I donate goods and money to others, it is enough', or 'I am not very generous, and by making such a decision will I compensate the balance?' This is certainly the area for further research, with a postulated inclusion of causal modelling.

**Personality** Studies confirm the thesis concerning the central role of agreeableness among the personality traits triggering prosocial behaviours (here, in the form of the decision to register as a PBMD), identified as a predictor of prosocial behaviours by the researchers (Graziano and Eisenberg 1997; Bekkers 2006; Habashi et al. 2016; Hill 2016; Zhao et al. 2016; Kline et al. 2017). Nevertheless, in the examined group, conscientiousness also occurred to be the predictor of primary importance for making the decision to register as a PBMD, the role of which so far in moderation of prosocial behaviours, including decisions to donate has been equivocal. Apart from agreeableness, the trait of conscientiousness as a predictor of donation behaviours was mentioned by Bolt et al. (2011) and

Demir and Kumkale (2013). This is in contrast with the results obtained by Kline et al. (2017), where conscientiousness was not related with prosocial behaviours, and Brown and Taylor (2015), who defined the traits of conscientiousness and neuroticim as even inversely correlated with behaviours of charity and philantrophic type (e.g., donating money and decisions to provide assistance). Nevertheless, Hill (2016), while indicating the lack of a relationship between conscientiousness and attitudes towards *post-mortem* organ donation and intentions to donate, suggests that this variable requires further studies (especially in the group of the young, the most desired donors), which is performed in the presented study. No relationship was found between openness to experience and prosocial behaviours in the form of registration as a PBMD, which contradicts the results of studies confirming the relationship between this trait and prosocial behaviours (Bekkers 2006; Brown and Taylor 2015).

**Self-Esteem** In the studies conducted to-date, the role of self-estem has also been investigated. A moderate relationship was found between self-esteem and prosocial behaviour in elementary school children (Larrieu and Mussen 1986), but there is a lack of research concerning youth and adolescents (Eisenberg and Fabes 1998). The presented study responds to this demand by testing the role of self-estem in a group of young adults. The study partly confirms a relationship between the decision about registration as PBMD and self-esteem, because it occurred in the decision tree and in normalized importance procedure as a significant factor of the effect, increasing the probability of making the decision to register as PBMD. However, self-esteem did not occur to be the variable of primary importance for making the decision of registration as a PBMD in the examined group, and was moderately related with this decision (the relationship was lower than personality traits and repeated prosocial behaviours in both active forms described).

*Functionality of the family system* and especially its characteristic, such as affective messages, and to a lower degree adaptation, proved to be the factors which actively, although moderately participate in the process of triggering readiness for making decisions to donate, and confirmed scarce studies of this phenomenon (Mac Donald 1984; Smith 1988; Okeafor and Chukwujekwu 2017; Booysen et al. 2018).

The results obtained demonstrate that the investigated variables (which to-date have been separately approached in studies) may interact with one another (hence, the Structural Equation Modeling (SEM) seems to be the technique of analysis anticipated for the future). A basis of sensitivity to the training of prosocial behaviours among personality traits seem to be mainly conscientiousness and agreeableness, with the accompanying positive affective climate in a family. It seems that prosocial behaviour is something which is 'worked out' in the family

home, being at least partly a behavioural effect and not only the result of a specified type of 'altruistic personality'. The results indicated that among family factors, emotions in the family, and particularly the relation of love and concern and showing love and concern, exerted the most significant effect on the decision to register as a PBMD. This seems to confirm the results of a study emphasizing that a substantial effect of living in a family is supporting positive affective conditions (Carlson et al. 1988), especially closeness (Kumru 2002; Tannen 2007; Putnick et al. 2018). This takes place by messages which provide for family members the feeling of concern, respect, and being valued, i.e., emotional messages. It may also be said that being preoccupied with a positive experience raises an individual beyond his/her problems of daily life, triggering tendencies towards prosocial behaviours. This may also be associated with the type of bond/attachment, causing certain effects, such as kindness vs. lack of kindness towards others (Mac Donald 1984; Smith 1988; Cassidy 2016; Okeafor and Chukwujekwu 2017; Booysen et al. 2018). This is of great importance, while the elements such as family partnership, growth and resolve, do not seem to be related with making the decision about a declaration to donate, or increasing the probability of making this decision only to a small degree.

People have a strong inclination towards spontaneous sharing of information with others, despite the fact that the recipient does not directly need to receive the information. Tomasello (2009) assumes that, due to this, the community with others expands and tightens, and in this way and on this basis there also develop common plans of action which further increase the area of common knowledge and experiences. This type of contact is perfectly pursued by a family by open sharing of emotions among its members. This is the training of the skills of functioning based on reciprocity, mutual benefits, building up trust, and a patient, long-lasting, remaining in a group living and working together. This may be related with the subsequent formation of patterns of safe and full trust, and the attitude of kindness towards people from the environment more external than the family, and consequently – prosocial/altruistic behaviours. It seems that encouragement for family discussions concerning the problem of donation in a positive emotional climate may be an important factor in paving the way to decisions to donate (Smith et al. 2004).

**Gender (Qualitative Analysis of the Composition of the Group)** The profile of the PBMD group ($n_M = 36.6\%$ and $n_W = 63.4\%$), which consisted mainly of females, indirectly confirms the conclusion that females are more predisposed to donation behaviours. Such observations are frequent in studied samples (Cleveland 1975; Cleveland and Johnson

1970; Steinman 2006; Thompson et al. 2003; Thornton et al. 2006; Ge et al. 2013; Gibek et al. 2017). McGlade et al. (2014) which showed similar gender proportions between people deciding to participate in studies of pro-donation behaviours; noting, however, that the choice of students of nursing might have caused this in a natural way (this profession is feminized). In the presented study, participation was a spontaneous decision not limited by any filters (except for age), and the results were similar. It is an interesting fact that females constituted not only the majority among those recruited for the PBMD study, but also the majority in the whole group reporting to the study ($n_M = 36.7\%$ and $n_W = 63.3\%$). Such a profile of the study group is not equivalent to the structure of Polish society in this age group,[10] which may evidence a greater readiness of females not only for honorary donation, but for considering this scope of problems at all (expressed by willingness to participate in the study).

**Limitations** The findings of the present study should be interpreted in the light of some limitations. Statistical analysis (LR and CART) did not consider gender which may be an important predictive variable. This variable was to be considered in the analysis; however, the group size did not allow this (too small a number of males who decided to participate in the study, especially in the PBMD group, which could result in a decreased reliability of results). Undoubtedly, taking into account the to-date results of studies and the indicated differences between genders with respect to readiness for donation actions, the variable of gender should be considered in future studies. Future studies, in agreement with Yunus et al. (2018), should also consider the possibility of the effect of socioeconomic background, age and religion, as well as parent's level of education, on the relationship between factors that influence dimensions of organ donation intention. Such analyses are planned in further studies concerning the detailed socio-demographic profile of PBMD.

A limitation may also be the use of *brief instruments;* however, they were used to minimize withdrawal from the study by the participants, and provide the respondents with maximum freedom. Although short scales tend to have weaker psychometric properties than longer ones, in the case of the scales used these differences were not very big, and the possibility of using a shorter measure is often a better solution than abandoning measurement altogether, especially when they have good psychometrical parameters (Łaguna et al. 2007; Dzwonkowska et al. 2008; Credé et al. 2012;

Sorokowska et al. 2014; Takenake and Ban 2016). Nevertheless, in the future, it is planned to use more comprehensive instruments for psychological measurement, especially with respect to the area of family studies, because the Family Apgar shows certain limitations in the measurement of family dysfunction[11] (Smucker et al. 1995; Gardner et al. 2001).

The *limited number of psychological variables* can also be a limitation. Here, an example may be the lack of consideration of the factors of the social environment (e.g. friends, educational or work environment), which may be one of the elements of predictive prosocial behaviours of young adults (Anantachoti et al. 2001; Cárdenas et al. 2010), because proper education conditions and positive attitude towards school, or a stable social environment, may have properties of strengthening prosocial tendencies (Kroeber 2011). This should be included into the future catalogue of the examined variables, such as the status of intimate relationship of the respondents or attitudes toward donation by their family members.

Another question is the value of conducting a *study* via *the Internet*. This may affect the standardization of research conditions, but due to such a procedure, the respondents were not connected with the researcher by the relationship of authority (they were not the researcher's students, which definitely excluded any conflict of personal interests[12]), they came from relatively varied places, being a good representation of the group of contemporary Polish young adults. Today, online research methods are ways in which researchers can collect data via the Internet (Kissau 2009; Kosinsky et al. 2016). Although it is accepted as a way of contact and data collection, it seems that in future research procedure it is worth conducting a parallel classical study using a paper questionnaire, which would allow assessment of the stability of the tendencies observed.

**"A Promise, Not an Action"** It should be remembered that the study does not investigate behavioural acts, but rather their declaration. Increasingly more people declare donating bone marrow; however, when it comes to donation, a part of them resign. Registration itself does not cost anything. Joining the PBMD registry is painless and takes a small amount of time, and only the donation of own cells and tissues is the completion of the declaration. Being included on the list of donors 'looks good' and may be the source of improvement of self-esteem and developing the personal image. In addition, it does

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[10] Among the Polish population aged up to 48, there occurs the preponderence of males – per 100 males there are approximately 97 females. (https://businessinsider.com.pl/wiadomosci/raport-gus-nt-stanu-i-struktury-ludnosci-w-2016/jgnwcrb), which even more strongly defines the profile of a potential participant as mainly female.

[11] Nevertheless, it should be remembered that the essence of the study was investigation of family functionality, and in this area, Family Apgar seems to be an adequate measurement instrument, especially with respect to adolescents and young adults (Shapiro et al. 1987). Family Apgar scores showed a high correlation with the Pless-Satterwhite FFI scores for the normal population (DelVecchio Good et al. 1979).

[12] May occur, e.g., in the case of studies conducted on own patients, schoolchildren or students, or any persons who in any other way have a relationship of authority with the researcher.

not mean that it will be necessary to actually make the donation. Thus, the study is rather an attempt to determine the predictors of readiness for prosocial honorary donation behaviour, and not the study of the sole behavioural act, which requires separate research. However, investigations demonstrate that studies of declarative behaviours of this type fall within the canon of modern science, and are evaluated as useful analyses of predictors of behaviours which are important from the aspect of social interest (Prakash et al. 2018).

Notwithstanding these limitations, this study offers further understanding on the effect of predictive factors on the decision among Polish young adults to register as PBMD. However, it should be emphasized that the obtained results should be approached as an indicated direction for further studies, and not as definite conclusions, because considering the character of the instruments used, as well as the character of the study group, the results obtained cannot be generalized to an excessively high degree. The findings from a sample of predominantly female university students, aged 18–25, may not necessarily be applicable to the wider community. In summing-up the suggestions for further studies, it seems that the following directions for research and analyses should be considered: performing a comprehensive socio-demographic characteristic of both the persons who decided to register as PBMD, as well as non-PBMD, construction of such a composition of the group would allow statistical analysis of gender as a predictive factor of the decision; performance of comprehensive statistical analyses with the use of causal modeling (e.g., SEM), in order to determine the precise character and strength of the relationships between the investigated variables.

## Conclusions

The presented study aimed to examine the utility of the SCT theory in predicting intentions to register as PBMD. For both registered and non-registered participants, the results of the study provided support for the validity of an extended SCT model applied in this context. Using a multimethod approach, the current study explored the general patterns underlying prosocial decisions, linking personality, family functionality, and prosocial behaviour. The results obtained by using the LR and CART allowed the formulation of predictive equations determining the probability of making the decision about joining the donor registry as an effect of repetition of practical prosocial behaviours (nevertheless, the character of this relationship requires explanation), and predestined by positive affective modelling in the family, the personality traits of agreeableness, conscientiousness and self-esteem. With regard to the hypothesis, strong support is found for a positive

relationship between the decision and personality traits of agreeableness and consciousness, self-esteem and family functionality.

Although the data obtained provide a basis for constructing a *hypothetical model of relationships* between the examined variables, and testing it preliminarily, it seems that the set of research instruments should be supplemented/modified, and the verification procedure based on SEM. At further research stages, trying to improve the quality of the analysis model used, an attempt will be undertaken to improve the quality of input data used for the building of the model (e.g., by increasing the records/cases used for analysis, use of more comprehensive instruments for psychological measurement) and increase in the number of potential predictors, in accordance with indications from literature. From the point of view of analysis of the results obtained, the decision to conduct investigations via the Internet was considered to be cognitively useful.

The study does not aspire to capture the full variety of plausible factors for registration as PBMD in one simple model, it is considered to be important to test a new hypothesis and account for these altruistic behaviours mediated by different factors. Discussing people's decisions to make a donation should involve more functional elements – impact of the role of family functioning, self-esteem. Personality traits influencing predicting decisions were also highlighted. It seems that altruistic donation can be enforced, building more cohesive and stronger families by using developmental social welfare and encouraging positive family discussion on the decision to donate organs.

## Compliance with Ethical Standards

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