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RESEARCH ARTICLE

The Scarcity of Organ Donors in Chile: How ER and ICU Professionals Can Make a Difference

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ABSTRACT

Background: Despite appropriate legislation and adequate financial coverage, organ donation rates in Chile remain low. Experts blame high familial refusal rates, while dismissing the effect of procurement process inefficiencies. Our objective is to study some of those inefficiencies.

Methods: Using a two-step approach, we started by obtaining two datasets, hospital discharges and organ procurements between years 2013-2017. We considered all patients that entered the system with a critical neurological condition according to ICD10, and exited dead; and all possible organ donors who entered procurement follow-up. Second, we administered a survey on healthcare professionals (physicians and registered nurses) in ER and ICU of 3 large hospitals in the capital, which aimed at describing procurement process knowledge and behavior. We used descriptive statistics for the analysis of both approaches.

Results: At the first analysis we found that 87% of patients qualifying as possible donors never entered procurement follow-up and, as 50% of families refused to donate, 6% of all possible donors became effective organ donors.

The survey was answered by 88 professionals. 50% physicians, 70% from ER. 51% declared they've actively detected a possible donor but 43% referred them to the Local Procurement Coordination. 10% of the surveyed population was not sure about the validity of brain death diagnosis, and 52% never received formal training on any organ donation topic while studying. 73% thought procurement activity was important, but 40% declared not knowing enough about it. ICU professionals were more knowledgeable than ER (81% vs 23% declared more than sufficient knowledge, $p < 0.001$).

Conclusions: The insufficient knowledge of procurement activity and concepts, especially from ER professionals may explain the lack of possible donor detection and referral found at a national level. Although the small sample may not be fully representative of the target population, the findings provide the insight that the efforts to increase Chilean organ donation rates should be put in educating healthcare professionals that participate in the procurement process, or even automating and standardizing the process to stop relying on people's knowledge.

Introduction

Despite that organ transplantation is the most cost-effective treatment for several end stage organ diseases ¹, a high number of patients die while waiting for a transplant ². This happens because organ supply, expressed as organ donation, is far smaller than organ demand. Despite there being two ways to become an organ donor: either by being a living kidney or liver section donor, or by being a non-living donor (after brain death or cardiorespiratory arrest death), organ donation rates in the world remain low. Worldwide, the ratio between living and non-living donors is around 1:1.6 ³.

However, global organ donation rates from dead donors are, in general, critically low. Spain is the leading country with 46 donors per million population (pmp), followed by the US with 44 pmp in 2021 ⁴. These figures are neither representative of the reality of the world nor European figures, which are only 19.48 pmp. Meanwhile, the reality of Latin America is even worse, with 7.26 pmp in 2021 ⁵.

Chile, despite having a legislation comparable to developed countries, which ensures coverage for the whole population and an organ donation opt-out system, has an average donation rate of 6-8 pmp. This low donation rate is explained mainly by two phenomena: the high rates of familial refusal towards donation, and insufficient possible organ donor (PD) identification and referral in hospitals ⁶.

But traditionally Chile had blamed high rates of familial refusal as the only explanation for the low organ donation rates, dismissing the effect of insufficient identification and referral, and correct procurement process management ⁷. In fact, in a former experience we discovered that most of the Chilean non-living donation rates are explained mainly by chance ⁶, which may be related to inefficiencies in the procurement process, both in the first stage of identification and referral, and during the subsequent maintenance stages.

The procurement process, which is carried out by Local Procurement Coordinations, can be divided in sub-processes or stages, which are ⁷:

1. Detection and referral of the possible donor in emergency rooms (ER), intensive care units (ICU)
2. Transfer of the possible donor (for those detected in ER) to an ICU for hemodynamic and metabolic stabilization, and maintenance
3. Brain death diagnosis (Chilean case)
4. Request of donation consent to the patient's family

5. Coordination and logistics of the extraction surgery and transfer of organs and tissues to the implantation institutions.

Following the same numbering, we will explain each stage, and mention some of the professionals that participate and their duties in them:

1. When the severely ill patient arrives at an ER, they receive attention from a multidisciplinary team: doctors, nurses, and technicians. During this diagnostic evaluation that includes lab and image tests, the patient receives physiologic support and, if required, is moved to the surgical room or the intensive care unit. In parallel, they could notice that the patient meets the possible donor criteria: they arrived with an acute neurological condition (stroke, anoxia, or head trauma, among others), they have a Glasgow Coma Scale score of 7 or less out of 15, and ideally, they are not under the influence of a sedative drug. Once someone from the clinical team detects the possible donor, they must refer them to the Local Procurement Coordination ⁸, a unit that in Chile is composed of registered nurses.
2. To transfer a patient to an ICU, firstly the patient must be admitted to it, something that may be limited due to bed availability or medical willingness ⁷. Despite there are guidelines and requirements for possible donor admission, the final decision always rests on the treating physician of the ICU. Once the PD is admitted to the ICU, they must receive standard of care together with some precautions that are unique to PDs ^{9,10}. In the care of a critical patient, all those professionals intervene, and also from different shifts ¹¹.
3. The only way a diseased patient can become an organ donor in Chile is by brain death diagnosis ¹², a diagnosis that is not exempt of controversies ¹³. To certify brain death, there are several conditions that must be met and, if there are doubts or not enough expertise, the procurement nurse may not have enough resources to continue with the process. The Chilean law demands 2 physicians to perform the apnea test and certify brain death, where at least one of them must be a neurologist or neurosurgeon, and none of them must be part of a transplantation program. Nonetheless, the participation of other professionals such as nurses is desirable and useful ¹².
4. In Chilean law, the procurement team is the only one who can request donation to the potential donor's family. But for that, the family must be notified about the death of their relative beforehand, and the treating physician is the one responsible for that ¹². Nonetheless, it is

desirable that a constant communication between the treating team (both at the ER and ICU levels) and the family is held in order to establish from the beginning the severity of the patient's condition and the high probability of death ¹⁰ (but never mentioning organ donation) ¹².

5. The role that ICU professionals play at this stage is maintaining a dead patient in the best conditions for organ retrieval, something that can last several hours until having surgical ward and surgeon availability ¹⁰.

As we can see, in each of these stages there are several healthcare professionals involved. The descriptions illustrate how labor-intensive a procurement process can be, and thus, how prone it is to fail, at least from the human-labor perspective. It would be interesting to know to what extent do the healthcare professionals know about their participation in the procurement process, and how much do they know, or admit to know, about the procurement process itself. Would a lack of knowledge explain, at least partially, the scarcity in organ donation rates in Chile?

Methods

To examine some of the inefficiencies in the procurement process that lead to low donation rates, beginning when a PD is identified until the family is asked for donation, we used two simultaneous methods, or a two-step approach. The first one intends to understand how many possible donors are lost at the first stage of detection and referral. The second step intends to explain the numbers obtained at the first stage from the healthcare workers' self-perception of participation and knowledge.

APPROACH 1

Aim: Determining the amount of PD lost in the first step of the procurement process.

We used the hospital discharge databases from hospitals all across the country between 2013 and 2017, as provided by the Ministry of Health (MH). We filtered for patients discharged as dead and with an admission diagnosis that suggested they could have suffered from brain death. Using expert knowledge, we considered 1,778 pathological health conditions according to ICD-10 (as granular as sub-diagnosis with 4 string codes), including different types of trauma, stroke, hypoxia, and hemorrhages, among others. A summary of the conditions are listed in Table 1. Being admitted to a hospital because of one of these conditions is one of the primary indicators that allow patients to be considered as a PD. The second one is being admitted showing a Glasgow Coma Scale value of 7 or less, but as we didn't access that information, we decided to consider only patients that were discharged as dead (patients will never become organ donors unless they die first). Additionally, we considered only patients younger than 76 years old (75 was the oldest a patient could be to become an organ donor in Chile at the time) ^{14,15}.

We matched that database with organ donation records between 2013 and 2017 from the MH's National Procurement and Transplantation Coordination. This last database contains the total number of PD (identified and entered to follow-up), ineligible patients (due to contraindications or other issues), patients whose families denied donation, and effective donors. For this comparison we used queries for basic statistics on PostgreSQL, this is, quantities, and percentages.

Table 1: Summary of ICD-10 diagnosis (3 string codes) that may lead to brain death, considered to filter hospital discharges as possible donors.

Type of diagnosis	Codes with 3 strings	N° codes with 3 strings
Hemorrhage	I60, I61, I62	3
Hypoxia	V90, V92, W65, W66, W67, W68, W69, W70, W73, W74, W75, W76, W77, W78, W79, W80, W81, W83, W84, X70, X71, X91, X92, Y20, Y21	26
Infection	A86, A87, A88, A89, G00, G01, G02, G03, G06, G07, G08	11
Inflammation	G09, G92	2
Stroke	G46, I63, I64, I67	4
Trauma	S01, S07, S08, V01 - V06, V09 - V89, V99 W01 - W27, W30 - W34, W41, X72 - X74, X80, X82, X93 - X95, Y00, Y01, Y03, Y04, Y22 - Y24, Y29, Y30, Y32	142
Tumor	C70, C71, D33, D42, D43	5

APPROACH 2

Aim: Determining the level of perceived knowledge and participation of healthcare workers in the procurement process.

We asked healthcare professionals involved in emergency rooms (ER) and intensive care units (ICU) about their level of knowledge and participation in the identification stage and the procurement process in general, and their own willingness to become an organ donor. We administered the questionnaire shown in Table 2 at the workplace of

each participant through an online survey (Google Forms) using tablets, during 2017 and 2018.

We purposefully chose 3 hospitals (2 public and 1 private) in Santiago, the capital of Chile, because of their comparatively high historical number of donors. The decision was based on having enough probability of participation in the procurement process and thus, obtaining richer information. This type of purpose bias in participant sampling is used in qualitative studies with the aim of obtaining better quality information since the ones that have a higher probability of participating in the activities under study should be able to better answer the questions.

Table 2: Survey administered to ICU and ER health professionals

N°	Question	Alternative
1	Do you work exclusively in this unit?	Yes/no
2	How do you feel about the workload?	Very low - Very high (1 - 5)
3	How is your relation with the unit (ER, ICU, Procurement)?	Very bad - Very Good (1-5)
4	What do you think about brain death?	Alternatives (includes "other")
5	Have you identified or been present at the detection of a possible organ donor?	Yes/No/Not sure
6	In which of the following stages of the procurement process have you participated?	Alternatives (includes "other")
7	Do you get to know if the patient became an organ donor?	Yes/Yes, and even the organs that were donated/No
8	Having that information...	I like it/It's useful/None of them
9	How familiarized are you with the procurement team's work?	Nothing / very much (1-5)
10	What do you think about the procurement team's work?	Alternatives (includes "other")
11	What do you think is the level of importance that organ donation has in your hospital?	Very low - Very high (1 - 5)
12	How has it changed over time?	Has not changed, It has become better, It has become worse
13	Would you be willing to donate your organs when you die?	Yes, No, Don't know
14	Why? (Differentiated by yes, no, don't know)	Alternatives (includes "other")
15	Demographics: Age, Sex, Hospital, Service, Time working there, Profession	Years, F/M, Hospital, ICU/ER, Less than 1 year/1-5/5-10/10-15/15-20/20-25/ more than 25, Physician/Nurse
16	Was donation and transplantation a subject, or was it treated as a subject at college when you studied?	Yes, No, Not sure
17	Have you had training courses in donation and transplantation?	Yes, No, Not sure
18	Who taught the training course you had?	Alternatives (includes "other")

We used descriptive statistics to explore the data (quantities, percentages, averages, and standard deviations), and chi-square tests to compare proportions between groups, using the Google Spreadsheet software. This study was approved by the Institutional Review Boards of all the participating institutions.

Results

APPROACH 1

Between 2013 and 2017, there were 18,905 patients admitted to a hospital with an ICD-10 diagnosis that could have ended in brain death and who were discharged as dead. Sixty percent of them (11,412) were younger than 76 years old.

During the same period, there were 1,480 patients identified as PD entering procurement follow-up, corresponding to just 13% of the PD shown above (1,480/11,412). In other words, 87% of patients who qualified as PD were never identified or referred to the Local Procurement Coordination (LPC), and so never entered procurement follow-up.

Of those 1,480 identified PD who started follow-up, 153 were further contraindicated (10%) because they were considered inappropriate due to a co-existing medical contraindication (for example, active cancer) or another reason (process failures, for example). As a result, 1,327 patients, only 12% of the initial number of PD, reached the stage where their families were asked to make a donation. Of those families, 668 (50%) refused to donate, leaving only 659 of the 11,410 initial PD (6%) converted into effective organ donors.

In summary, from a total of 11,412 possible organ donors, 1,480 (13%) were identified and referred, and just 659 (6%) became actual donors. This shows that there are, indeed, big sources of process inefficiencies that lead to effective organ donor losses.

APPROACH 2

Sample description

The survey (as shown in Table 2) was consented and answered by 88 healthcare professionals, 44 physicians and 44 nurses, out of which 43 were male and 45 female. Forty five of them (51%) came from public Hospital #1, 25 (28%) from private Clinic #1, and 18 (20%) from public Hospital #2. Sixty two (70%) of the responses came from ER staff, and 26 (30%) from ICU staff. The mean age was 36 years old (with a standard deviation of 10,9 years). Most of the respondents (38%) had been working in their workplace for 1 to 5 years, followed by 5 to 10 years (31%).

Most of those who answered the survey worked only in the unit where they were interviewed (64%, 56) and, out of them, 68% were nurses. Most of them declared that the workload in their units was from medium to very high intensity and that the working relationship between both units was quite good.

Organ donation perspective

In terms of their willingness to become an organ donor themselves, 86% (76) of the healthcare professionals declared they would like to become a donor, while 8% (7) would not, and 6% (5) were not sure about it. The main reasons given to be a donor were: "Because I can save lives" (74%), "Because I don't need organs after death" (53%),

"Because I participate in the process and I know it is transparent/honest/beneficial" (39%), "Because I know patients who have received a transplant" (33%), "Because it is the right thing to do" (28%), "Because I know patients on a waiting list" (26%), "Because I could need a transplant someday" (24%), and "Because it is a positive investment of time and resources for the hospital" (17%). Meanwhile, the reasons given for not becoming a donor were: "Because of religious reasons" (4), "Because I don't care" (1), and "Because transplants don't work well" (1). Finally, the ones given for not knowing whether to be a donor or not were: "Because I've never thought about it" (2), "Because the process is not clear and I don't know the results" (2), "Because I am not sure the medical staff goes out of their way to save me" (2), "Because it scares me" (2), and "Because I believe it would benefit people with power and influence and not who needs it the most" (1).

General knowledge in organ donation

90% of healthcare professionals surveyed believed that brain death is a valid diagnosis of death, while the other 10% had doubts or had never thought about it. 40% said they had covered topics related to donation and transplantation during their studies, while 8% were not sure. Only 42% stated they had attended a formal training course on organ transplantation and donation during their working life, where the teaching institution was the LPC (19%), "the unit where I work" (14%), the Transplant Unit (13%), or scientific conferences (11%).

Only 25% got to know if the patient became an actual donor, and 17% even got to know which organs were donated. The remaining 55% declared they did not enquire nor receive that information, most of them (98%) belonging to ER (significantly different from ICU: p -value < 0.0006). 61% said they like or would like to have that information, 40% said it is or would be useful, while 18% were not interested at all: 69% of which were physicians, but not significantly different from nurses (p -value = 0.097), and 75% of which belonged to the ER, also not significantly different from ICU (p -value = 0.66).

Participation in the procurement process

Most of the healthcare professionals surveyed had identified or had been present during the identification of a PD (83%) but only 62% of them had actively done it (which corresponds to 51% of the total surveyed personnel). The remaining 17% had never identified a PD. Only 43% of the healthcare professionals called the LPC after

identifying the PD, 36% required the support of another professional with greater medical expertise, and 27% referred the patient to the ICU instead. Only 25% performed the Glasgow Coma Scale exam, main indicator for referring possible donors.

38% had participated in collecting laboratory samples, 45% in handling the PD, 15% in talking with the family, and 13% in the apnea test. 26% participated in other activities such as diagnosis, assessment of laboratory samples, management of resources for maintenance, certification of death, and notifying the family of the brain death condition. 11% said they had not participated in any stage.

As physicians and nurses have different duties and take care of different variables during the procurement process, it is interesting to compare the different stages of the process that they declare to participate in. Table 3, shows the proportion of involvement of physicians and nurses in each activity. Out of these, it is interesting to observe that there is a statistical difference between professions in the identification of PDs, where more nurses

declare to identify or be present during the identification of the PD. Nonetheless, this difference is not significant when they were asked about active identification. We can also observe a statistical difference in the participation in the process in general, where more physicians declare to not participate in the process at all. Following the same analysis, it is interesting to observe that more nurses declare to participate in the maintenance of the patient. The last significant difference in participation, collecting laboratory samples, was expected to be higher in nurses. Nonetheless, performing the apnea test unexpectedly showed no significant differences, where the participation of physicians was expected to be higher than nurses since the law requires at least 2 physicians to perform it (only one of them neurologist or neurosurgeon). Finally, it was surprising that none of the professions declared a high participation in talking with the family of the patient, at least about the prognosis and status of the former. In summary, we observed a generally lower participation of physicians in the process as a whole and in specific stages or duties where they were expected to participate more.

Table 3: Survey responses in ICU and ER separated by the specific healthcare profession.

Stage	Participation	Nurse	Physician	p-value Chi-2
Had identified or been present during a PD identification	No	0,07	0,25	0,0194*
	Yes	0,93	0,75	
Does not participate in any stage	No	0,95	0,82	0,0439*
	Yes	0,05	0,18	
Receive the critical patient	No	0,48	0,45	0,8308
	Yes	0,52	0,55	
Identify the PD	No	0,52	0,45	0,5223
	Yes	0,48	0,55	
Refer the PD to someone with higher rank	No	0,57	0,70	0,1836
	Yes	0,43	0,30	
Refer the PD to the LPC	No	0,57	0,57	1,0000
	Yes	0,43	0,43	
Refer the PD to the ICU	No	0,75	0,70	0,6321
	Yes	0,25	0,30	
Collect laboratory samples	No	0,43	0,82	0,0002*
	Yes	0,57	0,18	
Maintenance of the patient	No	0,34	0,75	0,0001*
	Yes	0,66	0,25	
Talk to the family	No	0,91	0,80	0,1331
	Yes	0,09	0,20	
Perform the Glasgow Coma Scale exam	No	0,68	0,82	0,1396
	Yes	0,32	0,18	
Apnea test	No	0,91	0,84	0,3336
	Yes	0,09	0,16	

Table 4 shows the responses of the healthcare professionals belonging to ER and ICU in relation to their declared participation in each stage of the PD management, in percentage of the total respondents of each unit. We can observe that the stages that have a significant difference are the ones expected to have it. For example, it was

expected that ER personnel participate more in receiving the patient, in referring them to the ICU (instead of to the LPC), and in performing the Glasgow coma scale test (performed upon arrival). Similarly, we were expecting to observe a higher involvement of the ICU personnel in the maintenance of the patient. Nonetheless, it is interesting to not

observe a statistical difference in the performance of apnea test, because this is done almost at the end of the process, almost always at the ICU. Finally, it is also interesting to find that, despite the statistical

difference in receiving the patient, there was no difference in the identification of the possible donor.

Table 4: Survey responses of health professionals separated by their working unit

Stage	Participation	ICU	ER	p-value Chi-2
Had identified or been present during a PD identification	No	0,08	0,19	0,1620
	Yes	0,92	0,81	
Does not participate in any stage	No	0,88	0,89	0,9733
	Yes	0,12	0,11	
Receive the critical patient	No	0,77	0,34	0,0002*
	Yes	0,23	0,66	
Identify the PD	No	0,54	0,47	0,5448
	Yes	0,46	0,53	
Refer the PD to someone with higher rank	No	0,69	0,61	0,4799
	Yes	0,31	0,39	
Refer the PD to the LPC	No	0,54	0,58	0,7155
	Yes	0,46	0,42	
Refer the PD to the ICU	No	0,96	0,63	0,0014*
	Yes	0,04	0,37	
Collect laboratory samples	No	0,77	0,56	0,0703
	Yes	0,23	0,44	
Maintenance of the patient	No	0,38	0,61	0,0497*
	Yes	0,62	0,39	
Talk to the family	No	0,85	0,85	0,9166
	Yes	0,15	0,15	
Perform the Glasgow Coma Scale exam	No	0,92	0,68	0,0152*
	Yes	0,08	0,32	
Apnea test	No	0,77	0,92	0,0520
	Yes	0,23	0,08	

Knowledge about procurement

Regarding the perception about LPC duties, 73% declared thinking that the job of those who work in the LPC is very important, 41% declared thinking it is a good job, and 36% gave other opinions, such as: it is difficult, demanding, sacrificed, or exhausting. 5% declared not knowing what duties they had.

When healthcare professionals were asked about their awareness of procurement work and duties, they rated themselves as low as 2.9 ± 1.3 in a five point Likert scale even when they considered that the procurement and donation activities were important (3.7 ± 1.1) to the institution where they were working. Moreover, this low awareness was unequally distributed among healthcare

professionals. For example, in Figure 1 we can see that while 8% of the ICU staff declared knowing nothing or not enough about this issue, 53% of the ER personnel did so (24+29%). On the other hand, 81% (46+35%) of the ICU staff and 23% (19+3%) of ER staff declared to have high or very high familiarity with the procurement process. Making it clear that there are knowledge gaps that need to be filled in the emergency unit (p-value < 0.0002, when comparing both ICU and ER groups).

If this same question is compared between doctors and nurses, nurses seem to be better prepared, although not significantly, since 34% (25+9%) of physicians and 45% (30+16%) of nurses rated themselves as having high or very high knowledge (p-value = 0.76), as shown in Figure 2.

Figure 1: Familiarization or knowledge of procurement team's work separated by unit expressed in a scale from 1 to 5 or from "Nothing" to "Very high"

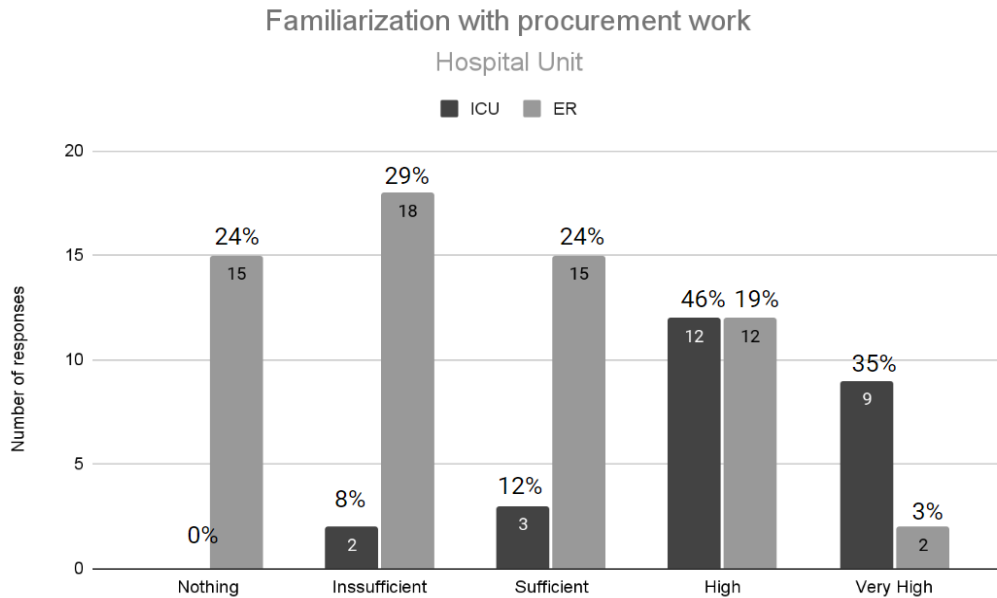
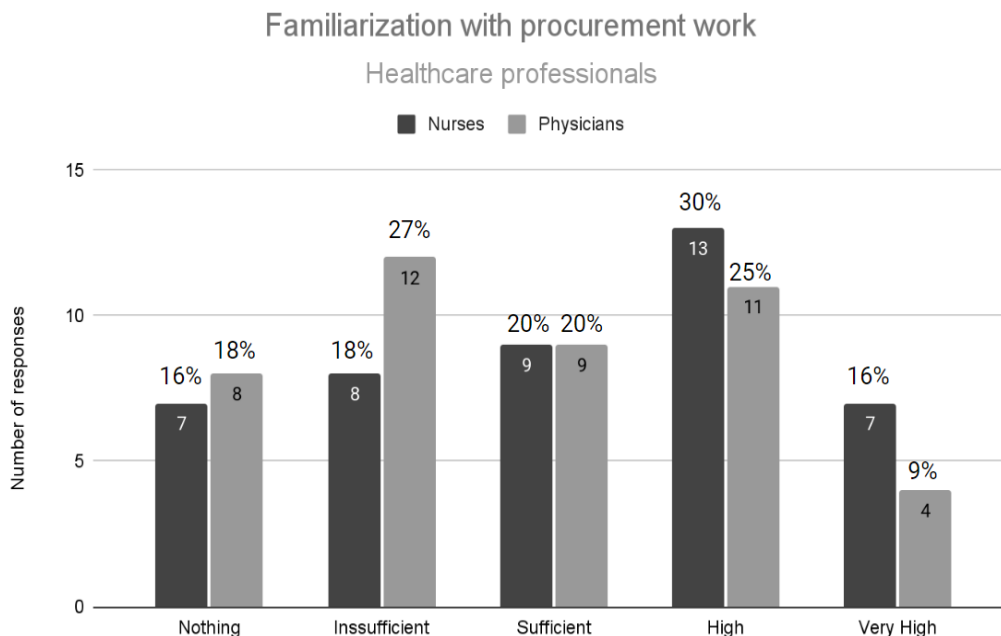


Figure 2: Familiarization or knowledge of procurement team's work separated by type of health professional expressed in a scale from 1 to 5 or from "Nothing" to "Very high"



Discussion

The process to achieve an actual donor from a PD is long and difficult, requiring complex teamwork from several healthcare professionals.

Our results show that, almost 90% of the PD were lost because they were not identified in ER or ICU, leaving just a small fraction of all PD to the LPC to try to achieve an actual donor, which is even more limited by a familial refusal rate of 50%. Despite the latter figure, the data shows that it is evident

that it is more efficient to increase PD detection and referral rather than trying to reduce familial refusal.

So, the question is: Why do we fail to properly identify and refer the PD to the LPC? By asking healthcare professionals who work in those clinical units about their knowledge and attitudes about donation and procurement, we came to the conclusion that the answer to the question is "lack of education and preparation".

For example, even though most professionals identified themselves as donors, the most frequent reasons cited by those who don't want to become an organ donor, or who are not sure about it, reveal a lack of preparation not only regarding donation and procurement (where they state to fear or be unaware about the steps and validity of the procurement process and its results), but also regarding the survival advantage of a functional allograft in a patient with an end-stage disease, or even the validity of brain death condition.

A PD is a critical patient that as other critical patients, must receive the proper care and must be referred to the unit capable of delivering that care. In fact, the Chilean law establishes that it is the responsibility of the treating physician to refer all PD to the LPC ^{12(p19451)}. This implies that those physicians must know how to identify and refer a PD. Although the majority of healthcare professionals who answered the survey declared that they had participated in the identification of a PD, less than 2 thirds of them declared being the one actively identifying the PD, which means that the rest realized it was a PD only after someone else mentioned it. Situation that is not surprising if we remember that only one fourth of the professionals declared to perform the Glasgow Coma Scale test, one of the main indicators for identifying a PD. We also noticed that the problem was not only with knowing when a patient should be considered a PD, but also with where the patient should be referred to. We found a discrepancy in who was notified about the PD, where the LPC was considered less than half of the times. So we discovered 2 big issues that may explain the low number of PD entering procurement follow-up as found in our first approach: ER and ICU professionals don't detect PD, and when they do, they don't refer them to the correct unit.

In terms of their participation in the rest of the process, it is worrying that somewhat less than half of the surveyed healthcare professionals declared to have participated in the clinical care of the PD. Even more worrying is that 11% declared not engaging in any clinical activity around a PD. But what may explain this low participation is simply the lack of awareness that a PD is a critical patient as any other, and that their maintenance and care is delivered by the teams that the same respondents belong to. In other words, there's a possibility that all of the respondents have participated in the procurement process without knowing or being aware of it.

To revert this lack of awareness it is crucial to educate ER and ICU professionals not only about

how to manage a PD, but also in the fact that they do participate in the procurement process, how they participate, and that this participation is fundamental for the output these PD have. As we saw in our results, only one fourth of the surveyed healthcare professionals got to know the outcome of the PD they identified, referred, and/or maintained, particularly if they became an actual donor. This information is a key piece of education that the LPC's have pending ^{16,17}. For the procurement team, it should be of strategic value to both share the outcome of the PD and provide feedback about how the care the patients received in the maintenance units may explain their outcome (both positive and negative). Empowering healthcare professionals and showing them how a donor can improve the life of patients waiting for an organ, can boost the activity, the care, and the perception of the importance of procurement (which is already high), and the perception of the goodness of it (which is not particularly high).

All the previous paragraphs are consistent with the finding that less than half of the healthcare professionals declared having received some instruction on organ donation while being students, or in the institution where they work. What is concerning is that while these professionals are not receiving the proper education in organ donation and procurement neither from their educational institutions, nor from their working places, they are still expected to know how to detect and refer a PD, and participate throughout the process to obtain effective donors.

We suggest focusing the first education efforts on the ER personnel since this group declared having a significantly lower knowledge of the procurement process, since most of the PD are admitted to the hospital at this unit ⁸ but their detection and referral is not statistically higher than in ICU, and since early referral (i.e., from ER rather than ICU) leads to more organ donors ^{18,19}. And even though educating physicians and nurses at the same time should be feasible, we suggest starting with physicians. This, because this group showed less knowledge and participation (or perceived participation) in the procurement process, and because they are the ones required by law to refer all PD to the LPC, and are the ones ultimately responsible for the outcomes of the patients.

A limitation or possible bias of our work is that we only surveyed healthcare professionals from three big hospitals involved in solid organ procurement and transplantation, a sample that may be small and not fully representative of the target population, that is, physicians and nurses at ER and

ICU of public and private hospitals in Chile. Nonetheless, our findings are consistent with the international literature^{11,20–26}, and we believe that they show us interesting insights about how well (or badly) trained our professionals are in organ donation and procurement. Even more considering that the 3 participating healthcare institutions are particularly sensitized and interested in procuring donors since they have transplantation programs.

Conclusions

Organ donation rates could improve by making PD identification easier, by training, educating, and motivating healthcare professionals, by giving them feedback about the outcome of the PD. We believe that innovative solutions should be considered for achieving the suggested improvements, like technological interventions capable of facilitating the detection and referral of PD, automating some of the stages of the procurement process, providing

continuous training to healthcare professionals, and giving feedback about their contribution to the procurement process, like an experience that increased PD identification and referral using a smartphone application for ER and ICU physicians and nurses²⁷.

Conflicts of interest statement

All authors declare that there is no conflict of interest regarding the publication of this manuscript.

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