

Congenital Cytomegalovirus Awareness and Knowledge among Health Professionals and Pregnant Women: An Action towards Prevention

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Mini-Summary

What does this study add to current knowledge?

- Only 47% of obstetricians and 28% of midwives inform patients about CMV congenital infection. Among pregnant women, scarcely 15% could identify preventive measures, and regardless of risk factors, 89% of pregnant women stated their need for information.

What are the main clinical implications?

- Health care providers and pregnant women in Catalonia have insufficient knowledge about congenital CMV infection. Health campaigns and continuing medical education strategies are warranted.

Keywords

Pregnancy · Congenital CMV infection · Health care professionals · Preventive measures · Awareness

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Abstract

Introduction: Cytomegalovirus (CMV) is a major cause of childhood disabilities, and consensus recommendations emphasize the importance of hygienic measures to reduce perinatal infection. Our study aimed to evaluate the level of awareness about CMV among health professionals and pregnant women. **Methods:** We submitted a 20-item online survey regarding CMV perinatal infection to all obstetricians and midwives in Catalonia (Spain) and a 7-item lay version of the questionnaire to 700 pregnant women. Levels of knowl-

edge were compared among groups. **Results:** Of the 1,449 health professionals approached, 338 surveys were answered. 72% of professionals considered CMV a relevant problem. 47% of obstetricians and 28% of midwives ($p \leq 0.001$) routinely informed pregnant women, and less than half knew the risk of fetal transmission. We observed significant differences in knowledge between obstetricians and midwives concerning the risks of recurrent infections, risk of transmission, and risk of severe infection (60.7% vs. 45.6%, $p = 0.006$ and 50.6% vs. 22.5%, $p \leq 0.001$); and regarding maternal and neonatal symptoms and newborn sequelae (23% vs. 8.8%, $p \leq 0.001$). Of the 700 women approached, we obtained a response rate of 72%. Only 23% had previously heard about CMV, 22% identified transmission routes, and 15% preventive measures. Compared to women without risk factors for CMV infection, women at greater risk had heard more about CMV (mothers of children <3 years: 36% vs. 20%, $p < 0.001$; occupational exposure: 43% vs. 20%, $p \leq 0.001$) and had received more information (mothers of children <3 years: 18% vs. 9.5%, $p \leq 0.001$; occupational exposure: 23% vs. 9.3%, $p = 0.001$). **Conclusion:** Health care professionals have limited knowledge about CMV and may fail to enforce preventive measures. While pregnant women have limited awareness about CMV infection, they recognize the need for information. Health campaigns should be promoted to enhance awareness about this perinatal infection.

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Introduction

Congenital cytomegalovirus (CMV) is the leading cause of nongenetical sensorineural hearing loss and a major cause of neurodevelopmental disabilities, with 0.4–1% infected newborns worldwide [1–3]. CMV is a complex virus since fetal infection may occur not only after primary maternal infection but also after reactivation or reinfection with a different strain [3, 4]. About 10% of infected newborns are symptomatic at birth and most present neurological and audiological sequelae. Among asymptomatic infants, however, around 10% will develop hearing loss [3, 5]. Nevertheless, this proportion depends on the time of maternal infection. A recent meta-analysis confirmed that fetal insult is around 25–30% when transmission occurs in the first trimester and periconceptional period, although fetal consequences are rare thereafter [4]. Since there is no available vaccine or effective therapy for infected fetuses, and while treatment to prevent fetal infection is under evaluation [6], universal screening of pregnant women is currently not recommended, and

most cases of congenital CMV infection remain unnoticed [7]. Exposure to young children is the greatest risk factor for primary infection as toddlers shed the virus in urine and saliva over a considerable period of time. Hygienic measures to avoid maternal infection are recommended by most consensus statements and pregnancy guidelines [8, 9]. Measures to be applied during pregnancy, specifically in the first trimester and the preconceptional period include handwashing after contact with urine or saliva from children <3 years; avoiding kissing near the mouth; and sharing utensils, food, and drinks with young children [10]. Although the studies analyzing these behavioral interventions were not randomized, several small studies demonstrated that these measures significantly reduce the risk of acquiring primary infection during pregnancy [10–12]. It has also been reported that this advice is more effective when given early in pregnancy rather than before, as pregnant women are more motivated to adhere to such recommendations [2]. Fellah et al. [13] recently stated that implementing educational programs could reinforce the impact of preventive measures and improve overall knowledge about CMV infection. They also demonstrated that the best-informed health care providers more frequently advised pregnant women [13]. The main objective of this study was to evaluate the level of awareness and knowledge among health professionals and pregnant women in a public, universal health care system (Catalonia, Spain). Our secondary aims were to assess whether there are differences between doctors and midwives and to determine differences in pregnant women related to their risk factors for the infection.

Materials and Methods

This was a descriptive, cross-sectional study on knowledge, attitudes, and practices with respect to congenital CMV among health professionals involved in prenatal care and pregnant women carried out between December 2018 and December 2019. This study was approved by the Hospital Clinic Ethics Committee: Reg. HCB/2018/1084/ER-01.

A 20-item survey was designed to evaluate knowledge about CMV infection among health professionals (online suppl. material 1; see www.karger.com/doi/10.1159/000525528 for all online suppl. material). All registered obstetricians ($n = 850$) (Catalan Society of Obstetrics and Gynecology) and midwives ($n = 570$) (Catalan Society of Midwifery) working in Catalonia were invited to anonymously answer the survey using an online platform. The questionnaire consisted of multiple-choice questions, with one or more valid answers. The answers were rated as correct when all the items of the questionnaire were answered accurately, partially correct when there was a failure or omission, and incorrect when all

the items were erroneous or the question was not answered. Professionals not involved in prenatal care were excluded from completion of the questionnaire.

A shorter lay-version survey comprising 7 questions (online suppl. material 2) was provided to 700 consecutive pregnant women who attended routine first-trimester scan between 11 and 13+6 weeks at the Fetal-Maternal Department, BCNatal-Hospital Clínic, Barcelona. To assess whether there were differences concerning the participants' knowledge, pregnant women were classified according to epidemiological risk factors related to CMV infection: having children ≤ 3 years old and occupational exposure in child-care centers. Additionally, their level of education was also recorded. Patients under 18 years of age and those with a language barrier were excluded.

Statistical Analysis

The level of knowledge of both health care providers and pregnant women was analyzed using the χ^2 , Pearson and Fisher's exact test for categorical variables. Trends across categories of educational status were obtained with the two-sample test of proportions. Quantitative variables were assessed using the Shapiro-Wilk test for normality. Non-normally distributed variables were expressed as median and interquartile range (p25–75). A p value < 0.05 was considered significant. Data analysis was performed using STATA, v.15.0 (College Station, TX, USA).

Results

Knowledge of the Health Care Professionals

Among the health professionals approached, 23% (338/1,449) completed the survey (Fig. 1). The results are summarized in Table 1. Health care professionals were surveyed about their perception of the relevance of CMV infection in our setting, and 76.4% of doctors and 69% of midwives considered it to be a relevant problem. However, only 47% and 28% of obstetricians and midwives (odds ratio; 95% confidence interval: 2.30 [1.46–3.63], $p = < 0.001$) routinely provided information to pregnant women. The main reasons for not giving information were lack of knowledge about the infection (52%), being a task not assigned to their functions (26%), not being recommended in the reference guideline (12%), and lack of time (10%). When health care providers were asked about how they perceived their knowledge of congenital CMV infection, 90% of the physicians and 94.3% of the midwives admitted having insufficient information.

Moreover, less than half of the professionals in both groups knew of the risk of fetal transmission and outcomes. Table 1 depicts the statistically significant differences observed regarding knowledge between obstetricians and midwives about the risks of recurrent infections and trimester of infection (84% vs. 65%, $p =$

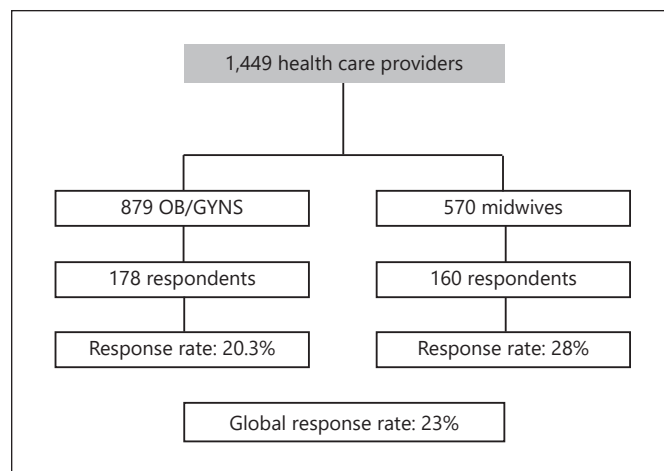


Fig. 1. Flowchart showing the health care providers involved in the study.

< 0.001 and 51% vs. 22%, $p = < 0.001$, respectively); risk of transmission; and risk of severe infection (60.7% vs. 45.6%, $p = 0.006$ and 50.6% vs. 22.5%, $p = < 0.001$); and also related to maternal and neonatal symptoms and newborn sequelae (23% vs. 8.8%, $p < 0.001$). Significant differences in the multiple-choice questions were related to all correct options but not partially correct answers.

Knowledge of the Pregnant Women

Among the pregnant women, 72% (505/700) completed the survey. The median (interquartile range) age of the participants was 34.5 (30.5–37.5) years. Their descriptive data are summarized in Table 2. Table 3 shows their responses to the survey compared to risk factors for infection (mothers of children < 3 years and occupational exposure). Of note, only 23% of the women surveyed answered to have previously heard about CMV and 11% had received information from health care professionals. Moreover, only 22% could identify transmission routes and 15% preventive measures.

Women at greater risk had heard more about the infection than mothers without risk factors (mothers of children < 3 years: 36% vs. 20%, $p < 0.001$; occupational exposure: 43% vs. 20%, $p < 0.001$) and had received more information (mothers of children < 3 years 18% vs. 9.5%, $p < 0.001$; occupational exposure: 23% vs. 9.3%, $p = 0.001$). However, when analyzing specific knowledge regarding the infection and preventive measures, there were no differences between pregnant

Table 1. Questionnaire items and comparison of responses by physicians and midwives

Question/item	Physicians (<i>n</i> = 178)	Midwives (<i>n</i> = 160)	Rate difference (95% CI)	<i>p</i> value*
Is congenital CMV infection a relevant problem?				
Correct, <i>n</i> (%)	136 (76.40)	111 (69.38)		
Incorrect, <i>n</i> (%)	42 (23.60)	49 (30.62)	(−0.025 to 0.165)	0.146
At least 50% of pregnant women are seropositive for CMV				
Correct, <i>n</i> (%)	101 (56.74)	56 (35)		
Incorrect, <i>n</i> (%)	77 (43.26)	104 (65)	(0.114–0.321)	<0.001
Identification of preventive measures				
Correct, <i>n</i> (%)	124 (69.66)	96 (60)		
Incorrect, <i>n</i> (%)	54 (30.34)	64 (40)	(−0.0051 to 0.020)	0.063
Preventive measures are effective				
Correct, <i>n</i> (%)	158 (88.76)	143 (89.38)		
Incorrect, <i>n</i> (%)	20 (11.24)	17 (10.63)	(−0.073 to 0.060)	0.856
Transmission routes				
Correct, <i>n</i> (%)	33 (18.5)	23 (14.4)		
Partially correct, <i>n</i> (%)	136 (76.4)	120 (75)		
Incorrect, <i>n</i> (%)	9 (5.1)	17 (10.6)		0.116
Reinfection/reactivation can cause fetal infection				
Correct, <i>n</i> (%)	150 (84.27)	104 (65)		
Incorrect, <i>n</i> (%)	28 (15.73)	56 (35)	(0.010–0.028)	<0.001
A validated treatment is not available				
Correct, <i>n</i> (%)	153 (85.96)	137 (85.63)		
Incorrect, <i>n</i> (%)	25 (14.04)	23 (14.38)	(−0.007 to 0.0079)	0.93
Mother symptoms				
Correct, <i>n</i> (%)	99 (55.62)	6 (3.75)		
Partially correct, <i>n</i> (%)	79 (44.38)	140 (87.5)		
Incorrect, <i>n</i> (%)	0 (0)	14 (8.75)		<0.001
Newborn symptoms				
Correct, <i>n</i> (%)	29 (16.29)	3 (1.88)		
Partially correct, <i>n</i> (%)	149 (83.71)	136 (85)		
Incorrect, <i>n</i> (%)	0 (0)	21 (13.12)		<0.001
Neonatal sequelae				
Correct, <i>n</i> (%)	42 (23.60)	12 (7.50)		
Partially correct, <i>n</i> (%)	134 (75.28)	129 (80.62)		
Incorrect, <i>n</i> (%)	2 (1.12)	19 (11.88)		<0.001
Should we screen pregnant women for CMV infection?				
Correct, <i>n</i> (%)	49 (27.53)	64 (40)		
Incorrect, <i>n</i> (%)	129 (72.47)	96 (60)	(0.225–0.024)	0.015
Risk of fetal transmission in 1st trimester				
Correct, <i>n</i> (%)	108 (60.7)	73 (45.63)		
Incorrect, <i>n</i> (%)	70 (39.33)	87 (54.37)	(0.0044–0.025)	0.006
Risk of severe infection				
Correct, <i>n</i> (%)	90 (50.56)	36 (22.50)		
Incorrect, <i>n</i> (%)	88 (49.44)	124 (77.50)	(0.183–0.378)	<0.001
Severity according to trimester				
Correct, <i>n</i> (%)	173 (97.19)	143 (89.38)		
Incorrect, <i>n</i> (%)	5 (2.81)	17 (10.63)	(0.026–0.137)	0.004
Do you give advice during pregnancy?				
Yes, <i>n</i> (%)	83 (46.63)	44 (27.50)		
No, <i>n</i> (%)	95 (53.37)	116 (72.50)	(0.091–0.292)	<0.001
Has insufficient knowledge about CMV				
Yes, <i>n</i> (%)	160 (89.89)	151 (94.36)		
No, <i>n</i> (%)	18 (10.11)	9 (5.63)	(−0.102 to 0.122)	0.129
If yes, when give information				
Pregestational, <i>n</i> (%)	12/81 (14.8)	7/44 (15.9)		0.871
First prenatal visit, <i>n</i> (%)	48/81 (59.2)	30/44 (68.2)		0.325

Table 1 (continued)

Question/item	Physicians (<i>n</i> = 178)	Midwives (<i>n</i> = 160)	Rate difference (95% CI)	<i>p</i> value*
First trimester, <i>n</i> (%)	16/81 (19.8)	3/44 (6.8)		0.050
Second trimester, <i>n</i> (%)	3/81 (3.7)	2/44 (4.6)		0.819
Third trimester, <i>n</i> (%)	2/81 (2.5)	2/44 (4.5)		0.529

Data presented as frequencies and percentage, *n* (%). CI, confidence interval; first prenatal visit, first contact with the patient (pregestational to third trimester); CMV, cytomegalovirus. * *p* value determined with the χ^2 or Fisher's exact test and the two-sample test of proportions.

women according to their epidemiological risk. Irrespective of the presence of risk factors, nearly 90% of the pregnant women included in this survey admitted there was a need for more information about congenital CMV. The knowledge about transmission and preventive measures significantly increased across educational level (linear trend $p < 0.001$), as shown in Table 4.

Discussion

The present study highlights that professionals involved in prenatal care in the Catalan public health system have insufficient knowledge regarding CMV infection. Inadequate and/or infrequent advice about behavioral measures could limit awareness of infection among first-trimester pregnant women, including those with risk factors such as having a young child or occupational exposure.

The CDC, the American College of Obstetricians and Gynecologists, and the most recent consensus recommendations emphasize the importance of advising pregnant women on CMV infection and preventive measures; however, in our setting, less than 50% of health providers routinely provide information about CMV. The importance of primary prevention has been stressed in previous studies and shown to be effective. Vauloup-Fellous et al. [12] concluded that providing information about hygienic measures can be a highly effective intervention in reducing the rate of maternal infection, describing a reduction in the seroconversion rate from 3% to 0.19% in a high-risk population. Moreover, in a study in Italy of 308 seronegative women with a child <36 months who received information at the beginning of pregnancy, the seroconversion rate was 1.2%, compared with 7.6% in a group of women who did not receive such information [10].

Table 2. Characteristics of the pregnant women (*n* = 505)

Variable	Value
Age, median (IQR)	34.5 (30.5–37.5)
Parity, <i>n</i> (%)	
Nulliparous	274 (54.3)
Pluriparous	231 (45.7)
Children, <i>n</i> (%)	
≤3 years old	94 (18.6)
≥3 years old or no children	411 (81.4)
Occupational exposition, <i>n</i> (%)	
Yes	64 (12.7)
No	441 (87.3)
Country of origin, <i>n</i> (%)	
Spain	282 (55.8)
Other country	223 (44.2)
Study level, <i>n</i> (%)	
Elementary school	25 (5)
High school	94 (18.6)
Technical school	64 (12.7)
University	322 (63.8)

Data are presented as median (IQR: interquartile range: p25–p75), frequencies or percentage (%).

In keeping with Shand et al. [14], only one-third of health care professionals were able to accurately identify all the preventive measures regarding CMV infection. Moreover, less than half of the obstetricians and only 28% of midwives routinely provided such information to pregnant women. Insufficient knowledge and the fact that this did not correspond to their tasks were cited as the main reasons for not offering information. Such findings are also consistent with those identified by Shand et al. [14] in which 37% of the health care professionals stated that they only occasionally offered information on CMV prevention, 32% claimed this was not standard practice, and 22% felt unsure of their knowledge. The sig-

Table 3. Questionnaire items comparing knowledge of women with/without risk factors for CMV infection

	Mothers with risk factors (n = 124)	Mothers without risk factors (n = 381)	Rate difference (95% CI)	p value*
Have you heard about CMV infection?				
Yes, n (%)	47 (37.90)	70 (18.37)		
No, n (%)	77 (62.10)	311 (81.63)	(0.10–0.29)	<0.001
Have you received information from a professional?				
Yes, n (%)	24 (19.35)	32 (8.40)		
No, n (%)	100 (80.65)	349 (91.60)	(0.04–0.19)	<0.001
Do you think CMV is preventable?				
Correct, n (%)	55 (44.35)	182 (47.77)		
Incorrect, n (%)	69 (55.65)	199 (52.23)	(0.06–0.13)	0.507
CMV causes no symptoms, but it can be dangerous?				
Correct, n (%)	41 (56.4)	167 (43.83)		
Incorrect, n (%)	83 (43.6)	214 (56.17)	(0.02–0.22)	0.014
Transmission routes				
Correct, n (%)	30 (24.19)	85 (22.31)		
Incorrect, n (%)	94 (75.81)	296 (77.69)	(–0.06 to 0.10)	0.664
Preventive measures				
Correct, n (%)	25 (20.16)	47 (12.34)		
Incorrect, n (%)	99 (79.84)	334 (87.66)	(0.006–0.16)	0.307
Do you think you should receive info?				
Yes, n (%)	108 (87.10)	338 (88.71)		
No, n (%)	16 (12.90)	43 (11.29)	(–0.04 to 0.09)	0.628

Data presented as frequencies and percentage, n (%). CI, confidence interval. * p value determined with the χ^2 or Fisher's exact test and the two-sample test of proportions.

Table 4. Knowledge concerning transmission routes and preventive measures of congenital CMV infection among women with different educational levels

	Elementary school (n = 25)	High school (n = 94)	Technical school (n = 64)	University (n = 322)	p value*
Knows transmission routes					
Yes, n (%)	3 (12)	4 (4.3)	7 (11)	101 (31.4)	
No, n (%)	22 (88)	90 (95.7)	47 (89)	221 (68.6)	<0.001
Knows preventive measures					
Yes, n (%)	0 (0)	4 (4.3)	6 (9.4)	62 (19.3)	
No, n (%)	25 (100)	90 (95.7)	58 (90.6)	260 (80.7)	<0.001

Data presented as frequencies and percentage, n (%). CMV, cytomegalovirus. * p value determined with the χ^2 or Fisher's exact test.

nificantly lower information given by midwives in our setting is particularly striking. It might have been due to a self-selection bias among obstetricians as low-risk pregnancies are usually followed by midwives who are generally responsible for behavioral interventions.

Obstetricians and midwives in our setting had low scores regarding knowledge about the infection, similar to results observed by other authors. In the Netherlands

in 2009, Korver et al. [15] reported that insight about congenital CMV among physicians involved in mother and childcare was inconsistent, and therefore pregnant women had very little awareness. In 2012, in France, Cordier et al. [16] concluded that only 9% of the health professionals were able to accurately identify infection transmission routes, being a finding similar to ours in which only 14% of midwives and 19% of obstetricians answered

this item properly. The fact that, at the time of the survey which was obtained before the results of the recent randomized trial by Shahar-Nissan et al. [6], 14% of midwives and physicians considered that an approved treatment for infected fetuses was available shows substantial deficiencies in their knowledge. The limited insight regarding treatment options was also found by Korver et al. [15] who in 2009 observed that 34% of health care professionals involved in prenatal care and 55% of pediatricians considered that prenatal treatment was already validated and available.

Our low response rate among obstetricians and midwives could be due to the fact that some of the professionals approached were not directly involved in prenatal care and were excluded from the survey. However, such a low response rate for professionals is similar to that reported in other studies and even higher as compared to that reported by Shand et al. [14] in Australia and New Zealand, with a 12.5% response rate among physicians.

The questionnaire carried out in pregnant women obtained a higher response rate (72%). This might be explained by the face-to-face distribution and the greater motivation and concern of women to receive information during pregnancy.

In 2015, Willame et al. [17] observed that only 19.7% of pregnant women surveyed in Switzerland reported having received information about CMV from a health care professional, being a figure similar to ours. Mothers of young children, which are by far those at greater risk [18, 19], were slightly more aware of the infection but did not, however, demonstrate greater knowledge about transmission or preventive measures. Nevertheless, women with work exposure showed more knowledge of preventive measures which could have been acquired within the work environment. In Canada, Wizman et al. [20] also reported that 85% of postpartum women were unaware of CMV infection, and, likewise, working at a childcare center was associated with better knowledge. As confirmed in other surveys, educational level was related to better scores [17, 21, 22].

It should be pointed out that around 89% of the pregnant women surveyed stated that they should be told about CMV infection, which confirms what was previously reported in a study by Revello et al. [10] in which 93% of participants considered that they should receive information during pregnancy. Such motivation towards acquiring new knowledge, mainly about preventive measures and the potential damage that CMV infection can produce in the fetus, would be beneficial for future educational interventions in our population. Based on our initial findings, educational projects should be organized

in order to enhance the knowledge/awareness of the population and health care professionals. In addition, timely information and preventive measures to reduce the deleterious consequences of CMV infection at the beginning of pregnancy and periconceptionally should be provided. A video showing primary prevention measures has already been recorded at our center and is shown in the waiting rooms of our Maternal-Fetal Department.

Our study has some limitations. First, there might have been a self-selection bias among the professionals surveyed leading to an overestimation of knowledge. Since congenital CMV infection is considered a complex topic, the health care providers who decided to participate may have had more interest, knowledge, or affinity for the issue. This could be more relevant among obstetricians given the fact that they gave more behavioral advice than midwives. Second, the higher-than-expected proportion of respondent women with a university education could have also represented a self-selection bias that led to an overestimation of knowledge among pregnant women. Finally, CMV prevention measures have only been confirmed for the prevention of primary infections [18], but due to the characteristics of the study, it was not possible to ascertain the percentage of women already immune.

Conclusion

In conclusion, prenatal health care providers attending pregnant women in Catalonia have limited and unequal knowledge about CMV infection, and pregnant women have low awareness that might place them at high risk of infection. Since the majority of professionals and pregnant women expressed a need for more information, health campaigns and health care education strategies should be promoted.

Statement of Ethics

This study protocol was reviewed and approved by the Hospital Clinic Ethics Committee: Reg. HCB/2018/1084/ER-01. The study did not require written informed consent under approval of the same committee.

Conflict of Interest Statement

Prof. Eduard Gratacós is the Editor-in-Chief and Prof. Francesc Figueras an Editorial Board Member of *Fetal Diagnosis and Therapy*. The rest of the authors have no conflicts of interest to declare.

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Author Contributions

All authors fulfill all conditions required for authorship, have seen and approved the manuscript, and all have significantly contributed to the work as follows: Anna Gonc , Karen Castillo, and Ameth Hawkins-Villarreal (conception and design of the study); Karen Castillo, Marta Vald s-Bango, Marta L pez, Laura Guirado, Elena Scazzocchio, Oriol Porta, and Gemma Falguera (acquisition

of data); Ameth Hawkins-Villarreal, Anna Gonc , Karen Castillo, and Francesc Figueras (analysis and interpretation of data); Anna Gonc  (supervision); Anna Gonc , Karen Castillo, and Ameth Hawkins-Villarreal (writing – original draft); Anna Gonc , Karen Castillo, Ameth Hawkins-Villarreal, Montse Palacio, Eduard Gratac s, and Francesc Figueras (revision and editing of the submitted article).

Data Availability Statement

The data that support the findings of this study are not publicly available due to their containing information that could compromise the privacy of research participants but are available from the corresponding author Anna Gonc  upon reasonable request.

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