UNIVERSITÀ DEGLI STUDI DI TRIESTE

Dipartimento Universitario Clinico di Scienze mediche, chirurgiche e della salute

Laurea Magistrale in Medicina e Chirurgia

Cost-effectiveness of the italian screening protocol for international adoptees

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"Every single minute matters,
every single child matters,
every single childhood matters."

- Kailash Satyarthi, Indian children's rights activist

Abstract (Italian)

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Abstract

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Acknowledgements

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Abbreviations

MCV   **M**ean **C**orpuscolar **V**alue

VBA   **V**isual **B**asic for **A**pplications

Chapter 1

Introduction

Children's health has historically always been a sensitive and concerning matter for human kind. We can find reason for this in our universal instinctive draw towards the protection and care for our offspring, and in how children can be struck by some of the most devastating and life-wrecking diseases. Sometimes, these are the phenotypical expression of genetical marks, scarred onto and into these kids. Despite the origin, the color of the skin or the culture the child bears in his lineage, human beings feel the need to raise and safeguard them from all harms, on a physical, emotional and spiritual level. This is one of the strongest biological calls to action.

Thus, pediatrics must care and remember that children's health and well-being must be guarded across political borders, across poverty, across starvation. This thesis, and the paper it's so deeply bound to, set themselves to renew this vow.

1.1 Intercountry and international adoptees

International adoptees are children with special needs: a vulnerable paediatric population with a chronic condition that requires access to a wide variety of health care services (as defined by [6] and [7]). Compared to 19% of the general population, approximately 39% of adopted children require special healthcare attention

(as extensively explained in [1]). They are of school age, part of a sibling group, members of historically oppressed racial or ethnic groups, or they have considerable physical, emotional, or developmental need: all potential elements of vulnerability endangering the child's healthy upbringing. This is not a limited problem: annually more than 30.000 kids are adopted across countries, and, in the United States, of all 136.000 national adoptees in 2008, almost 25% come from foreign countries; U.S. families adopted 22.884 children in 2004, mostly from China (which accounts for 33% alone), Ehtiopia, Russia and South Korea (see [1]), 8.868 more in 2012 and 4.714 in 2017 (see [3]). Further data on annual U.S. international adoptions and their social and financial costs can be found at [4].

Although personal experiences obviously vary, most children placed for international adoption have some history of poverty and social hardship in their home countries, and approximately 65% are adopted from orphanage or institutional settings. As explained in [1], the effects of institutionalization and other early life stresses impact all areas of early growth and development. As a result, many children require specialized support and understanding to overcome such impacts and to reach their full potential.

Moreover, as in [2], internationally adopted children may withstand a number of juridical and social impairments even after adoption. No generalization can be made on this matter though, since laws and policies greatly differing among countries. They may be stripped of their name (a.e. in Cape Verde, Argentina and Turkey), have no right to inheritance (a.e. in Republic of Moldova and France), see the termination of the relationship with birth parents and relatives (a.e. in Japan, Albania and Togolese Republic), loose their citizenship and not acquire a new one (a.e. Hungary and New Zealand), or even bear limitations on marriage in their adult life (a.e. in Argentina and France). These boundaries are to be considered associated to the emotional and psychological stress of new surroundings, new affections, new habits, and even new climatic environments (which can be clinically relevant, as explained in 1.3.2.2).

All these elements account for some of the factors that contribute to the hardships an adoptee must endure throughout his life and call for a strong action from

pediatric physicians and social services employees, as possible support figures which may change these kids' lives forever.

1.1.1 Levels and trends in intercountry adoption worldwide

International adoption is increasingly considered a measure of last resort worldwide, if the child's birth family or community are unable or unwilling to care for him anymore (see [1]), justifying the downward trend on international adoptions across the globe.

The United Nations Population Division estimates that about 40.000 intercountry adoptions took place each year around 2005, accounting for 15% of the total number of adoptions (see [2]). As shown in Table 1.1 and 1.2, the involved countries, both for destination and origin, are relatively few.

Destination countries are led by the United States with over 127.000 total adoptions in 2001 Even though it accounts for nearly half of all adoptions, only 15% of American families decide to take care of a child coming from outside the US. France and Spain (both with a significant annual adoptions, ranging from 4,000 to 5,000 adoptions per year), instead, embrace 80-90% of all adoptions from foreign lands, although they have far less total adoptions per year. Almost all countries adopt primarily from China and Russia, confirming data shown in 1.2. The median percentage of international adoptions in all examined countries is 64 a remarkable value and effort in helping children from developing countries.

The Italian adoption status will be discussed in 1.1.2.

Rank	Receiving country[1]	Number	Percentage	Main country of origin
1	United States of America	19.056	15	China
2	France	3.995	90	Haiti
3	Spain	3.951	82	Russia
4	**Italy**	**2.177**	**68**	**Russia**
5	Germany	1.919	34	Russia
6	Canada	1.875	46	China
7	Sweden	1.093	65	China
8	Netherlands	1.069	78	China
9	Denmark	688	55	China
10	Norway	664	76	China
11	Switzerland	558	79	Colombia
Median		370	64	

Source: United Nations Population Division report (see [2])

Countries of origin are better balanced throughout the globe, with China leading the chart, followed by Russia, Guatemala and Ukraine. Guatemala and Ethiopia stand out for the exceptional percentage of international adoptions among all, with 97% and 93% respectively. As clearly shown in Table 1.2, the United States are the preferred destination country for most of the listed nations.

All of the countries listed below struggle with some sort of social hardship: political instability, poverty, inequality, starvation, ethnic or civil wars, complex and violent pasts. Eyes can't closed and mouths shut, when it so obviously portrayed that children are the ones paying from these adulthood failures. They must run, be saved, separated, deported in order to be granted one single chance, one single hope.

Rank	Receiving country[1]	Number	Percentage	Main receiving country
1	China	8.644	19	United States
2	Russia	5.777	25	United States
3	Guatemala	3.726	97	United States
4	Ukraine	2.672	35	United States
5	Korea	2.258	58	United States
6	Vietnam	1.419	49	United States
7	India	1.098	36	United States
8	Bulgaria	1.010	44	**Italy**
9	Kazakhstan	948	26	United States
10	Colombia	846	60	France
11	Ethiopia	810	93	France
Median		50	34	

Source: United Nations Population Division report (see [2])

In Table 1.4 the leading countries both of origin and of destination have been divided for the most oriented towards international adoptions out of all national adoptions per year. Belgium, France and Luxembourg lead the receiving side; Ethiopia, Guatemala, Mali and Thailand the origin side, instead, with over 90%.

60 to 74%	75 to 89%	90% or more	60 to 74%	75 to 89%	90% or more
Andorra	Cyprus	Belgium	Colombia	Georgia	Ethiopia
Australia	Liechtenstein	France	Latvia	Haiti	Guatemala
Israel	Netherlands	Luxembourg	Grenada		Mali
Italy	Norway		Honduras		Thailand
Singapore	Spain		Niger		
Sweden	Switzerland		Togo		

(A) Receiving Countries   (B) Countries of origin

Source: United Nations Population Division report (see [2])

---

[1] Only countries with more than 500 adoptees per year were included. For the complete table, please see the referenced source.

1.1.2   International adoptions in Italy

According to [6], [7] and [8], Italy is the European country with the highest rate of adoptions and the second one worldwide, following the United States. This major role was kept in the next two-year period: 2.716 children were internationally adopted in Italy in 2016-17 (see [9]). As of [2], Italy is the forth country worldwide for international adoptions with 2.177 international adoptions in 1999, amounting to 68% of national total. Most of the Italian adoptees are from the Russia Federation (as shown in Table 1.1) and Italy is Bulgaria's favorite country of destination (in Table 1.2).

1.2   Health status and screening protocols

Screening at arrival is important in order to identify eventual pathological conditions. Several reports focused on infectious disease risk among internationally adopted children (IAC), while data regarding prevalence and spectrum of non-infectious conditions, including special needs, are poor (see [6] and [7]).

1.3   Illnesses and dysfunctions under exam

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1.3.1 Infectious diseases

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1.3.2 Blood count disorders and deficiency states

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1.3.2.1 Iron-deficient anemia

it can occur.

1.3.2.2 Vitamin D deficiency

it can occur too.

1.3.3 Height-weight disorders

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Chapter 2

Materials and Methods

2.1 The data set

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2.1.1 The population in exam

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2.1.2   Inclusion and exclusion citeria

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2.2   Data set elaboration

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2.2.1   VBA expressions

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All VBA expression can be found in Appendix A at page 25.

2.2.2 Cut-off values

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2.2.2.1 Haemoglobin

This was a little prick.

2.2.2.2 MCV

This was ANOTHER little prick.

2.2.2.3 Circulating Iron

This was easy.

2.2.2.4 Vitamin D

Vitamin D is healthy. 25OH...

2.3 Statistical Analyses

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Chapter 3

Results

3.1 Introduction

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3.2 Risultati 1

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nec ornare sapien. Fusce ipsum justo, interdum quis libero a, mattis tristique velit. Phasellus rhoncus lorem non ultrices luctus.

3.3   Risultati 2

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3.4   Risultati 3

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Chapter 4

Discussion

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4.1   Objectives achieved

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4.2 Our recommendations

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4.3 Future work

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Chapter 5

How to Do

This is all I know on LaTex up to now.

5.1 Including Sections and Subsections

This is my first section.

5.1.1 I like myself

I'm nice.

5.1.2 but I'm weird

but fun.

5.1.2.1 LOST OF FUN!

Writing writing and writing.

5.1.2.2 I'm calm and shit

I write stuff in subsubsections.

And lastly this is new and amazing PARAGRAPH: You can write whatever you want and it's pretty cool and new. I still like subsubsections more.

5.2 Including references and citations

This is pretty simple to cite: developed as open-source C++ software by Rudolf Biczok [10]. We'll learn more about this as we go. Let's see if they change order [6]. They should've change [7].

5.2.1 Referencing images and tables!

So you can see figure 5.1 at page 23. AMAZING
OR you can also see the table 5.1 at page 23!

5.2.2 Referencing chapters and subchapters

You can also ref chapters, as Chapter Results 3.

5.2.3 Using footnotes

Let's try this out.[1] And another one to see if it is progressive and shit.[2]

---

[1]This is my first footnote.
[2]CAREFUL! Don't leave any spaces before the command or they will be rendered.

I'll try now to "place them manually". This is were the sign is.[3]
Somewhere else in the text. I insert what it contains.

5.3   Including quotes

This is how a quote looks.

> From an evolutionary perspective, virtual reality is seen as a way to over-come limitations of standard human-computer interfaces; from a revolutionary perspective, virtual reality technology opens the door to new types of applications that exploit the possibilities offered by presence simulation.

And also in text quotes: "[by] immersing the user in the solution, virtual reality reveals the spatially complex structures in computational science in a way that makes them easy to understand and study".

And dots. . .

5.4   Including URLs

We can include `https://github.com/vrcranfield/UnityApplication`.

5.5   Including code

The following code is written by Lorenzo:

---

[3]This is my footnote!

```
=IF(
   OR(
      E68 = "Russia";
      E68 = "Albania";
      E68 = "Bulgaria";
      E68 = "Ungheria";
      E68 = "Ucraina";
      E68 = "Moldavia";
      E68 = "Romania"
   );
   "Europa dell'Est";
   IF(
      OR(
         E68 = "Burkina Faso";
         E68 = "Etiopia";
         E68 = "Costa d'Avorio";
         E68 = "Congo";
         E68 = "Guinea Bissau";
         E68 = "Africa";
         E68 = "Ghana";
         E68 = "Benin"
      );
      "Africa";
      IF(
         OR(
            E68 = "Colombia";
            E68 = "Brasile";
            E68 = "Guatemala";
            E68 = "Peru";
            E68 = "Costa Rica"
         );
         "America del Sud";
         IF(
            OR(
               E68 = "Armenia";
               E68 = "India";
               E68 = "Cina";
               E68 = "Vietnam";
               E68 = "Sri Lanka";
               E68 = "Siberia";
               E68 = "Nepal";
               E68 = "Filippine"
            );
            "Asia";
            ""
         )
      )
   )
)
```

5.6   Formatting Text

This is BOLD *This is ITALIC* This is SANS SERIF This is TRUE TYPE
In this sentence THIS IS TINY. THIS WHOLE SENCE IS TINY.

I go back to normal.

Then I can go for large, or Large, or Larger, or Huge and even HUGE.

5.7   Including bulleted list

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam quam tellus, venenatis a consectetur non, pretium ac nunc. Nullam eu tellus sed augue laoreet scelerisque.

- The first item of your list

- The second item of your list

- The third item of your list

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam quam tellus, venenatis a consectetur non, pretium ac nunc. Nullam eu tellus sed augue laoreet scelerisque. Curabitur efficitur, dolor ut pretium fermentum, nisi enim pulvinar nunc, non bibendum urna odio nec neque. Cras tellus turpis, posuere in dictum vitae, vestibulum quis velit.

1. The first item of your list

2. The second item of your list

3. The third item of your list

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam quam tellus, venenatis a consectetur non, pretium ac nunc. Nullam eu tellus sed augue laoreet scelerisque. Curabitur efficitur, dolor ut pretium fermentum, nisi enim pulvinar nunc, non bibendum urna odio nec neque. Cras tellus turpis, posuere in dictum vitae, vestibulum quis velit.

a) The first item of your list

b) The second item of your list

c) The third item of your list

5.8 Including Figures

Orci varius natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Nam vulputate finibus malesuada. Praesent at egestas turpis. Vivamus vitae tellus malesuada, laoreet ex ac, venenatis est. Aliquam dictum tincidunt libero, cursus posuere arcu sodales non. In sed metus sit amet arcu vestibulum mollis ut vel nibh. Nam non velit tortor. Integer ac sapien a purus porta convallis. In vestibulum aliquam nunc vitae faucibus. Etiam tristique iaculis orci, vel aliquam felis accumsan et. Nulla ultricies, nisl eu malesuada lobortis, ante metus faucibus libero, vitae blandit odio enim sit amet tortor.

5.9 Including Tables

Orci varius natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Nam vulputate finibus malesuada. Praesent at egestas turpis. Vivamus vitae tellus malesuada, laoreet ex ac, venenatis est. Aliquam dictum tincidunt libero, cursus posuere arcu sodales non. In sed metus sit amet arcu vestibulum mollis ut vel nibh. Nam non velit tortor. Integer ac sapien a purus porta convallis. In vestibulum aliquam nunc vitae faucibus. Etiam tristique iaculis orci, vel aliquam

FIGURE 5.1: Living room as I imagine it

Source: Photo courtesy of HTC

felis accumsan et. Nulla ultricies, nisl eu malesuada lobortis, ante metus faucibus libero, vitae blandit odio enim sit amet tortor.

Day	Max Temp	Min Temp
Mon	20	13
Tue	22	14
Wed	23	12
Thurs	25	13
Fri	18	7
Sat	15	13
Sun	20	13

(A) First Week

Day	Max Temp	Min Temp
Mon	17	11
Tue	16	10
Wed	14	8
Thurs	12	5
Fri	15	7
Sat	16	12
Sun	15	9

(B) Second Week

TABLE 5.1: Max and min temps recorded in the first two weeks of July

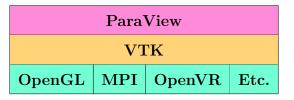| ParaView			
VTK			
OpenGL	MPI	OpenVR	Etc.

Table 5.2: ParaView-VTK Architecture (simplified)

Appendix A

Data set elaboration: VBA expressions

This appendix provides all the code used in this thesis to elaborate the data set. Visual Basic for Application (VBA) is the programming language chosen for this purpose, as the most effective and manageable way of elaborating data in excel sheets. Further information can be found throughout this thesis, especially in Section 2.2 at page 10.

In the following appendix, cells are indicated as combination of a letter (identifying the column) and a number (identifying the line), as they originally were in the database. Every line represents a single child's evaluation; every column represents one of the examined parameters. The full column-parameter correspondence can be found in following Table A.2.

Column	Parameter	Unit of measure (or cell content type)	Description
A	First and last name	*text*	The name of
B	Sex	*text*	The sex of th
C	Age (in months)	months	The age of th

---

[2]Although registering the name of the patient posed a risk in terms of possible privacy breach, it was added nonetheless to easily identify each patient as the data set got larger through the years.

D	Age (in years)	years	*. For furthe
E	Nation of origin	*text*	*.
F	Geographic area of origin	*text*	*.

TABLE A.2: Column-parameter correspondence

A.1 Age (in months)

This VBA expression checks the *Age (in months)* column (C) and, if it's not empty, it divides it's value by 12, rounding it down, just as age works.

The `ROUNDDOWN` function was implemented in order to avoid overestimating child's age.

```
=IF(
   C2 <> "";
   ROUNDDOWN(
      C2 / 12;
      0
   );
   ""
)
```

A.2 Geographic area of origin

To further understand how geographic origin influenced the results of our screening program, every nation was grouped up in 4 major continents or areas with the following excel expression.

```
=IF(
   OR(
```

```
      E2 = "Russia";
      E2 = "Albania";
      E2 = "Bulgaria";
      E2 = "Hungary";
      E2 = "Ukraine";
      E2 = "Moldavia";
      E2 = "Romania"
   );
   "Eastern Europe";
   IF(
      OR(
         E2 = "Burkina Faso";
         E2 = "Ethiopia";
         E2 = "Ivory Coast";
         E2 = "Congo";
         E2 = "Guinea Bissau";
         E2 = "Africa";
         E2 = "Ghana";
         E2 = "Benin"
      );
      "Africa";
      IF(
         OR(
            E2 = "Colombia";
            E2 = "Brazil";
            E2 = "Guatemala";
            E2 = "Peru";
            E2 = "Costa Rica"
         );
         "South America";
         IF(
            OR(
               E2 = "Armenia";
               E2 = "India";
               E2 = "China";
               E2 = "Vietnam";
               E2 = "Sri Lanka";
               E2 = "Siberia";
               E2 = "Nepal";
               E2 = "Philippines"
            );
            "Asia";
            ""
         )
      )
   )
)
```

A.3 Pathological values

The data set contained numerical values for many laboratory analyses. Cut-off values for these results were established via the most recent literature review, as explained in Section 2.2.2. In the following sections, the code used to establish which ones where pathological and which were not, is displayed and shortly explained.

A.3.1 Weight and height

These parameters, since they had already been converted to percentile values, were easily implemented with the following simple VBA expression:

```
=IF(
   H2 <> "";
   IF(
      H2 <= 10;
      1;
      0
   );
   ""
)
```

A.3.2 Haemoglobin

Hemoglobin required a more complicated and sophisticated expression, in order to be stratified, because hemoglobin pathological cut-offs depend on various factors, as described in Section 2.2.2.1. Moreover mild, moderate and severe anemias had to be separated in order to properly evaluate the child's health status; each one had an arbitrary value of 1 (*mild*), 2 (*moderate*) or 3 (*severe*) associated to it.

```
=IF(
   L2 <> "";
   IF(
```

```
AND(
    C2 >= 6;
    C2 < 60
);
IF(
    L2 >= 11;
    0;
    IF(
        AND(
            L2 < 11;
            L2 >= 10
        );
        1;
        IF(
            AND(
                L2 < 10;
                L2 >= 7
            );
            2;
            3
        )
    )
);
IF(
    AND(
        C2 >= 60;
        C2 < 132
    );
    IF(
        L2 >= 11,5;
        0;
        IF(
            AND(
                L2 < 11,5;
                L2 >= 11
            );
            1;
            IF(
                AND(
                    L2 < 11;
                    L2 >= 8
                );
                2;
                3
            )
        )
    );
    IF(
        AND(
```

```
                    C2 >= 132;
                    C2 < 168
                );
                IF(
                    L2 >= 12;
                    0;
                    IF(
                        AND(
                            L2 < 12;
                            L2 >= 11
                        );
                        1;
                        IF(
                            AND(
                                L2 < 11;
                                L2 >= 8
                            );
                            2;
                            3
                        )
                    )
                )
            )
        );
        ""
)
```

A.3.3   MCV

As just described for haemoglobin, MCV required more complicated techniques in order to be stratified, because of its variability (through age, sex, ecc. . .), as described in Section 2.2.2.2. Moreover, boolean results couldn't be accepted for this parameter, so arbitrary values were used to appropriately identify microcytic (*1*) and macrocytic (*2*) anemias.

```
=IF(
    N2 <> "";
    IF(
        B2 = "F";
        IF(
            AND(
```

```
        C2 >= 0;
        C2 < 60
);
IF(
    N2 > 85;
    2;
    IF(
        AND(
            N2 <= 85;
            N2 >= 69
        );
        0;
        1
    )
);
IF(
    AND(
        C2 >= 60;
        C2 < 120
    );
    IF(
        N2 > 89;
        2;
        IF(
            AND(
                N2 <= 89;
                N2 >= 75
            );
            0;
            1
        )
    );
    IF(
        AND(
            C2 >= 120;
            C2 < 168
        );
        IF(
            N2 > 92;
            2;
            IF(
                AND(
                    N2 <= 92;
                    N2 >= 78
                );
                0;
                1
            )
        )
```

```
			)
		)
	);
	IF(
		B2 = "M";
		IF(
			AND(
				C2 >= 0;
				C2 < 60
			);
			IF(
				N2 > 85;
				2;
				IF(
					AND(
						N2 <= 85;
						N2 >= 71
					);
					0;
					1
				)
			);
			IF(
				AND(
					C2 >= 60;
					C2 < 120
				);
				IF(
					N2 > 88;
					2;
					IF(
						AND(
							N2 <= 88;
							N2 >= 76
						);
						0;
						1
					)
				);
				IF(
					AND(
						C2 >= 120;
						C2 < 168
					);
					IF(
						N2 > 90;
						2;
						IF(
							AND(
```

```
                            N2 <= 90;
                            N2 >= 76
                        );
                        0;
                        1
                    )
                )
            )
        )
        );
        ""
    )
);
""
)
```

A.3.4   Circulating iron

The following VBA expression was used to establish whether circulating iron levels were insufficient.

```
=IF(
    P2 <> "";
    IF(
        AND(
            P2 >= 16;
            P2 <= 129
        );
        0;
        1
    );
    ""
)
```

A.3.5 Ferritin

The following VBA expression was used to identify pathological ferritin values. These were, again, stratified for *mild* (*1*), *moderate* (*2*) and *severe* (*3*) deficiencies.

```
=IF(
   R2 <> "";
   IF(
      R2 >= 20;
      0;
      IF(
         AND(
            R2 < 20;
            R2 >= 15
         );
         1;
         IF(
            AND(
               R2 < 15;
               R2 >= 10
            );
            2;
            IF(
               R2 < 10;
               3
            )
         )
      )
   );
   ""
)
```

A.3.6 Vitamin D

The following VBA expression was used to establish whether Vitamin D (serum *25-hydroxycholecalciferol*) values were *insufficient* (*1*), *deficient* (*2*) or *severely deficient* (*3*). The predictive choice for this marker is explained at Section 2.2.2.4.

```
=IF(
```

```
   AA2 <> "";
   IF(
      AA2 >= 50;
      0;
      IF(
         AND(
            AA2 < 50;
            AA2 >= 25
         );
         1;
         IF(
            AND(
               AA2 < 25;
               AA2 >= 10
            );
            2;
            IF(
               AA2 < 10;
               3
            )
         )
      )
   );
   ""
)
```

Column	Parameter	Unit of measure (or cell content type)	Description
A	First and last name	*text*	The name of the kid.[1]
B	Sex	*text*	The sex of the kid.
C	Age (in months)	months	The age of the kid.
D	Age (in years)	years	*. For further information, see Section A.1.
E	Nation of origin	*text*	*.
F	Geographic area of origin	*text*	*.
G	Residency time in Italy (in months)	months	*.
H	Weight	percentile	*.
I	Pathological weight	*boolean*	*.
J	Height	percentile	*.
K	Pathological height	*boolean*	*.
L	Haemoglobin	g/dl	*.
M	Pathological haemoglobin	*boolean*	*.
N	MCV	fl	*.
O	Pathological MCV	*boolean*	*.
P	Circulating iron	µg/dl	*.
Q	Pathological circulating iron	*boolean*	*.
R	Ferritin	ng/ml	*.
S	Pathological ferritin	*boolean*	*.

TABLE A.1: Column-parameter correspondence

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