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Front Pages

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A World Association of Academics and Researchers
8 Valaoritou Str., Kolonaki, 10671 Athens, Greece.
Tel.: 210-36.34.210 Fax: 210-36.34.209
URL: https://www.athensjournals.gr/ajms Email: journals@atiner.gr

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The current issue is the first of the eighth volume of the *Athens Journal of Mediterranean Studies (AJMS)*, published by the Athens Institute for Education and Research.

Gregory T. Papanikos
President
ATINER

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- Abstract Submission: **13 February 2022**
- Submission of Paper: **14 March 2022**

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- Abstract Submission: **21 February 2022**
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- Submission of Paper: **16 May 2022**

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- **Dr. Yannis Stivachtis**, Director, Center for European & Mediterranean Affairs and Associate Professor, Jean Monnet Chair & Director of International Studies Program, Virginia Tech – Virginia Polytechnic Institute & State University, USA.

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Athens Journal of Mediterranean Studies - Volume 8, Issue 1, January 2021 – Pages 11-28

Pottery Styles in Transition in Iron Age Crete

By Eleonora Pappalardo[*]

This paper presents the preliminary results of the study carried out by the author on a precise class of materials: Protogeometric B pottery from the site of Prinias, in central Crete. The pottery comes from the excavations conducted in the necropolis of Siderospilia, used from the end of XII century BC until the VII/VI century. A large assemblage of material has been so far analyzed, mostly consisting on figured specimens. Among this, a particular class of pithoi, characterized by straight sides and mostly used as cinerary urns, stands out for its quite unique features, finding comparisons just in Knossos and in few other Cretan sites. The impressive figured repertoire adopted in decorating PGB pottery (850-800 BC) does not find comparisons in continental Greece and it seems to reflect some sort of mixed tendency between Near Eastern influences, involving Crete in Early Iron age, and Minoan background.

Keywords: *Prinias, Protogeometric B, Pithos, Crete, Aegean*

Introduction

The term Protogeometric B refers to a very short span of time, occurring within the second half of IX century B.C. in Crete (850-800).

During these 50 years, however, several interesting features characterize different aspects of Cretan society and material culture, not only for what concerns craftsmanship and material production in general. In this period, in fact, social transformations occurred in association with the adoption of new burial costumes and space's organization, and probably connected with a general increasement of economy and trade activity throughout the Mediterranean basin (Pappalardo 2012).

Researches concerning Cretan Protogeometric period must be considered crucial for the comprehension of the more general socio-political dynamics involving Mediterranean Dark-Age, inasmuch as they focus into a period of reconfiguration of complex societies (Lemos 2002).

They rise issues concerning East-West relationships, new commercial routes and enterprises, meetings of cultures far from each other, formation and, then, transformation of social structures (Kotsonas 2006, Stampolidis 1998, Stampolidis and Karageorghis 2003).

This is the period in which the roots of the concept "Greek Polis" sink and the preparation of a precise social and ideological substratum takes place.

[*]Professor of Classical Archaeology, University of Catania, Italy.

The Cretan Protogeometric B period (PGB) chronologically coincides with mainland Middle Geometric, but differs from it for several stylistic features mostly concerning pottery production.

The central role of Crete in the renewed interconnections with Near East, starting from the early X century BC, determined an almost sudden adoption in the island of a handicraft production rich of figured features, stronlgy influenced by the composite Oriental repertoire (Pappalardo 2013). In this phase, indeed, the first experiments in figured art are performed, resulting from a mixture between Near Eastern, Egyptian and Minoan traditions (Pappalardo 2019). The PGB pottery, in this context, emerges for its distinctive shapes (in some cases totally different from the Protogeometric ones) and, mostly, for the richness of its figurative repertoire.

In this paper, I will present the preliminary results of a project I am carrying out thanks to grants awarded by the University of Catania and the INSTAP (Institute for Aegean Prehistory) of Philadelphia.

This project aims to provide, for the first time, a systematic analysis of the PGB pottery in Crete, which will start from the large, and, as yet unpublished assemblages from the site of Prinias, in central Crete (guide-site for the study of the birth of the Greek *polis* and the only one providing evidence both from settlement and from necropolis) so as to then compare it with the Cretan production of the rest of the island.

Part of PGB pottery found during the excavations of the necropolis of Siderospilia, in Prinias, started from 1973 (Rizza 1973, 1974), will be analyzed and compared with the one already known from the excavations of the Knossos necropolis of Fortetsa and North Cemetery (Brock 1957, Coldstream and Catling 1996). The work will be organized as follows.

1. Presentation and description of the material studied.
2. Typological and stylistic classification.
3. Comparison with the materials already published.
4. Analysis of specific features and figural stylistic patterns.
5. Interpretation of its meaning and function in its context of find.

Background and Literature Review

The second half of the IX century BC in Crete coincides with significant transformations in several aspects of material culture. An almost evident change in burial costumes and in architectural choices seems to be symptomatic of a new condition of Iron Age Cretan people.

For what concerns craftsmanship, in general, and pottery production, in particular, a general improvement of quality is detectable, and an increased use of figured ecoration (Pappalardo 2011a, 2011b, Kotsonas 2013). This is the period in which near eastern figured bronzes and carved ivories start to spread through the Eastern Mediterranean, and Crete must be counted among the regions where hugest amount of both was found (Markoe 1985, Matthäus 1996, Pappalardo 2005, 2012, 2019, Stampolidis and Karageorghis 2003).

In this general picture, a new pottery production starts to appear, mainly in funerary contexts (Rizza 1974, Brock 1957, Coldstream and Catling 1996, Pappalardo 2015, 2019), apparently consisting of richly decorated straight-sided pithoi, used as cinerary urns, often covered by a clay lid recalling the decorative scheme of the vases. Their typological and stylistic originality, in the general panorama of the Protogeometric pottery, in particular the wide use of naturalistic elements (such as trees, birds, fishes and human figures) freely painted on the whole surface of the vases, has raised debates about the real meaning and origin of this production (Kotsonas 2013, Pappalardo 2015). Already at the times of the publication of the Fortetsa Cemetery near Knossos (Brock 1957) and, subsequently, of the North Cemetery of the same site (Coldstream and Catling 1996), the use of these vases was put in relation with social status of people buried in the cinerary urns: on one hand, the fact that PGB straight-sided pithoi were mainly found inside chamber tombs (in one case close to a Minoan figured Larnax), associated with rich funerary goods, brought to the interpretation of their use as symbol of a common membership to be linked with the glorious Minoan Past; on the other hand, their rich figurative apparatus, associated with the sudden increase of near Eastern imports in Crete, has been interpreted as a clear and intentional adoption of new (Oriental) artistic influences.

Materials and Methods

The increased number of new sites discovered in Crete (Englezou 2004, Kotsonas 2008) and, at the same time, the possibility to study the huge assemblages of PGB pottery retrieved from the excavations at Prinias, carried out either in the settlement on the Patela (for a synthesis see Palermo et al. 2017) and in the Iron Age cemetery of Siderospilia (Palermo 2019, Pautasso 2018, 2019, Rizza 2019, Pappalardo 2015, 2019), offer an important tool for investigating this enigmatic pottery production in relation with the respective contexts of find.

It is now possible, in fact, to firstly try clarifying the role of PGB vases in the transition from Protogeometric to Geometric period, trying to detect those features already present in the previous LPG (Late Protogeometric) pottery and those developed in the EG (Early Geometric) ones. On this respect, for example, the necropolis of Siderospilia provides important information about the adoption of that decoration, proper of PGB straight-sided pithoi, on bell kraters typologically belonging to Late Protogeometric period.

In the meantime, it is possible to compare PGB figured vases with the plain ones, in order to understand if PGB must be considered just a "pottery style" or a chronological phase, involving more than one aspect of material culture.

The macroscopic and microscopic study of the Prinias assemblages, furthermore, has to be compared with the evidence provided by other Cretan sites, in particular Knossos, by adopting a synergic approach. Then, the old hypothesis that Prinias must be viewed as a peripheral center of PGB production in comparison with Knossos could be confirmed or disproved.

A preliminary study of the material from the necropolis, kept in Prinias storerooms, as said above, has been carried out, by paying particular attention to the straight-sided figured pithoi; they were found mainly in tholos tombs J and F and in tomb W, while a large quantity of sherds was scattered in a wide area of the cemetery.

The analysis has already highlighted that a local workshop produced pithoi of high quality, slightly different in shape and style.

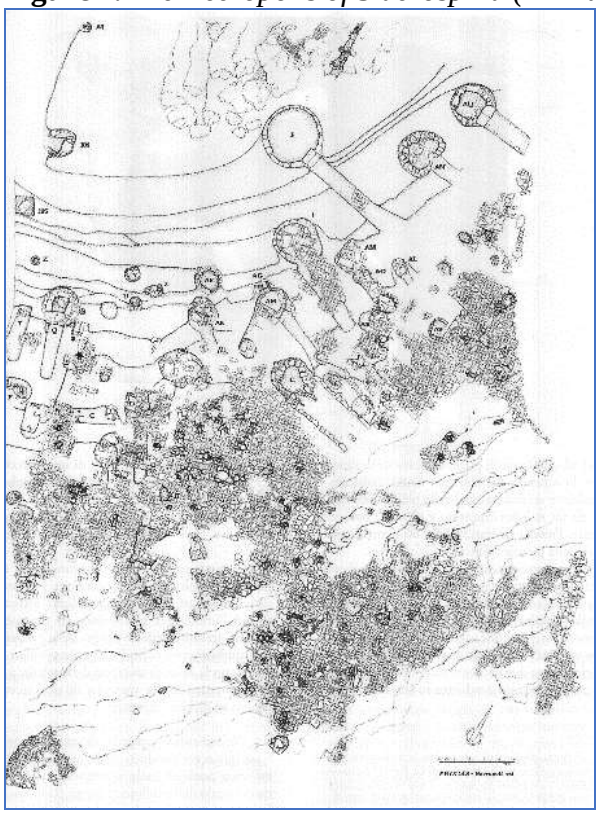
The recognition of internal differences is a fundamental step for advancing the hypothesis of an internal development (from the Late Protogeometric to the Early Geometric period).

In the meantime, the systematic analysis of the common pottery found in the same tombs where PGB figured vases were found seems to testify an internal development almost consistent with the one recorded at Knossos.

According to a preliminary counting of all the PGB pottery from the necropolis, almost 100 vases and big fragments from specific tombs have to be studied, while a huge amount of sherds from the superficial stratum covering the whole area of the necropolis must to be still documented (about 20 boxes). Another important assemblage is kept at the Heraklion Museum, mainly consisting in those vases integrally preserved and brought to the Museum at the time of their discovery.

Siderospilia necropolis seems to well reflect the new asset of the moment (see Figure 1).

Figure 1. *The Necropolis of Siderospilia (Prinias)*



Source: Archaeological Mission of Prinias.

PGB pottery is, in fact, well represented in the cemetery and characterized by a significative diffusion through the area, as Salvatore Rizza recently showed (Rizza 2019, 2020).

Generally speaking, the study of the tombs and offerings provides a complex mass of information concerning funeral architecture, burial costumes, craftsmanship, spatial organization, social and economic dynamics from the Late Bronze Age to the Orientalizing Period. It can be reasonably considered a unique study-case, inasmuch as the results of its study can be compared with the evidence emerging from the settlement and the sacred area. In this respect, the complete study of its features has given rise to some intriguing considerations concerning the role of the site in the general Cretan context and its direct involvement in dynamics of mobility and cultural exchanges (Palermo 2019).

The necropolis of Siderospilia was investigated by the Archaeological Mission of the University of Catania, directed by Giovanni Rizza, during ten campaigns from 1969 till 1978; several tombs of different kind were brought to light, providing a lot of funerary goods, in part kept in the Iraklion Museum (Rizza 1971, 1973, 2011).

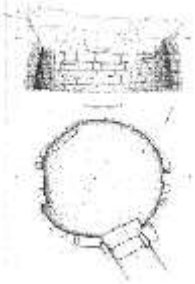
The necropolis extends over an area of 8000 m^2, on a low hill. The cemetery can be divided into two main phases of frequentation. The first phase starts at the very end of the Late Minoan III C period and is characterized by the contemporaneous presence of both inhumation and incineration funerary practices. The second phase starts in the IX century BC, and is characterized by incinerations only. With regard to the first phase of use it should be stressed that incineration seems to be linked with pit tombs carved in the rock, while inhumation, is specifically associated with chamber tombs of a "pseudo tholos" type, partially excavated into the rock. Both tomb typologies develop in parallel. At the North/North-East of the hill, close to the pit tombs, the tholoi were found. They share a circular and pseudo trapezoidal plan, covered by a flat roof of wide slabs.

As far as the largest amount of PGB straight sided pithoi was found inside two of the major pseudo-tholoi of the cemetery, tombs J and F, I'll briefly describe them.

Both tombs were robbed and destroyed in antiquity as was demonstrated by the presence of fragments belonging to vases found inside them, just below the stones covering the second phase incineration tombs.

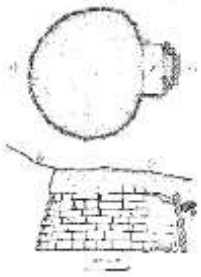
The roofs of both tombs were collapsed inside the chambers and unfortunately a big amount of depositions was found in the rubbles and in part outside the tomb.

Figure 2. *Tomb F (Prinias)*



Source: Archaeological Mission of Prinias.

Figure 3. *Tomb J (Prinias)*



Source: Archaeological Mission of Prinias.

Tomb F (see Figure 2) has a diameter of 3.80 m; excavated in high sector of the hill, it was accessed through a long corridor (dromos) with a South-East orientation. For what concerns tomb J (see Figure 3), placed at the south of F, it has a diameter of 2.75 m, entirely inlaid within the rock; the entrance was opened at the South-East, paved by a wide slab used as a threshold. Inside the tombs a stone sarcophagus was found, close to the wall.

The Pottery

As in Knossos or Eleutherna, in this period an improvement of metal depositions[1], local and of a foreign origin as well, is widely attested in the Prinias Necropolis, associated with PGB pottery, inaugurating a trend destined to continue in Geometric time.

In terms of shapes and types, the area provides an almost complete repertoire of the PGB pottery, starting from the vases of big dimension to the minor ones comprising also the miniaturist specimens.

From tomb J, a lot of pottery was found, mainly formed by a complete drinking set of bell-skyphoi and one-handled cups, plausibly to be connected with precise rituals performed in honour of the dead.

Figure 4. *Pithos from Tomb J (Prinias)*

Source: Photo by Author.

[1]The metal objects found in the Siderospilia necropolis of Prinias were studied by Matthäus (2016).

Just one large portion of the upper wall of a PGB figured straight-sided pithos comes from this tomb, of an exceptional quality of clay, and painting as well, carrying along the rim a line of tiny "S" (see Figure 4).

On the main body two birds and the back of a third, all resting up on trees. Two birds have the arched body filled with chessboard motive; the body of the third, partially preserved, is, instead, empty. By observing the stylistic rendering of figures represented on these PGB vases, it can be noted that one bird, the one just partially preserved, differently form the others, has got the wings: a small arch filled with parallel lines recalling the decoration of the body rim.

Whereas the recurrent subjects of PGB pottery are usually birds and trees, it must be underlined that this vase provides the only example of decoration formed just by a paratactical series of trees surmounted by small birds, quite exactly recalling an example from Knossos (Coldstream, Catling 1996, Figure 133).

In this case, furthermore, a macroscopic observation of the clay, seems to show a different colour and texture, rather yellowish and finer than the rest of PGB pottery from Prinias, in general characterized by a reddish colour and a solid composition[2].

More numerous are the examples of PGB pithoi from Tomb F.

As well as for its dimensions, tomb F emerges for the nature of the finds: along with the figured PGB vases, in fact, a considerable number of metal objects and choroplastic was found inside it.

A big fragment of straight-sided pithos decorated with brown band at the base and three trees (see Figure 5): the trunk is rendered through two tiny lines to which spiral branches are attached. The representation scheme of the tree is very linear and simple. The trunk rises directly from the tiny lines decorating the base.

A second fragment presents slightly convex upper walls. On the shoulder a series of arches filled with small lines is painted; on the upper wall wide panel houses two big birds facing one with the other: the body is arched and recalls the decorative motive on the shoulder; in the centre a sort of spiral pinwheel.

The metope's rim is filled with zig-zag motive and, on the left a rosetta is inscribed in a circle.

Belonging to the same vase is a wide portion of wall and base richly decorated: the walls are unusually tiny and the profile elegant and concave (see Figure 6).

[2]An interdisciplinary project concerning iron age pottery from Prinias is actually in progress, stopped by the Covid Pandemic diffusion, involving the INSTAP Institute, in particular the colleague Heleni Nodarou. The project is aimed to provide a general picture of the clay composition of the vases coming from the excavation of the monumental building at the South of temples and B, sampled on the base of a stratigraphic criterion, and in the large assemblage kept in consideration, small fragments of PGB pottery are included.

Figure 5. *Pithos P. 246, from Tomb F*

Source: Photo by Author.

Figure 6. *Pithos P. 243, from Tomb F*

Source: Drawing by Orazio Pulvirenti.

Part of a frame is preserved on the left, in correspondence of the handle, and, in the main area, the lower portion of a big bird with arched body, completely filled with scales, a fan-shaped tail and tiny bent legs is represented. The rest of the vase surface is filled with stylised trees bearing spiral branches and crowned by small oval leaves.

Another fragment of straight-sided pithos (P244/244b) (see Figure 7) comes from the Tomb: a big portion of the convex walls and shoulder with inset rim; the attach of the double bar handle, very high, is posed at about the half of the vase's wall. Differently from the previous specimen, the decoration is organised onto three registers: the upper housing lozenges on a black ground, filled with chessboard decoration;

The central register bears vegetal stylized features characterized by peculiar elongated and sinuous petals filled with small lines, recalling sea plants; In the lower register, finally, is a chain of fishes, whose body is bounded by a double rim filled with zig-zag, while internally is decorated by parallel bands. The fish's face is trapezoidal, with round eye, while the tails are fan-shaped.

Figure 7. *Pithos P. 244, from Tomb F*

Source: Photo by Author.

Figure 8. *Pithos P. 251 A/B, from Tomb F*

Source: Photo by Author.

Probably belonging to same vase are other fragments (251A/B) (see Figure 8) carrying analogue decoration.

My opinion is that they belonged to the other side of the pithos, being characterized by a different disposition of the decoration. In fact, instead of the lozenges, you can see a row of fishes made in an almost different style from the previous ones, more nearly recalling the decorative scheme of the shoulder.

From tomb F comes another fragment of pithos (P242 + 253): a portion of the wall and shoulder, the double bar vertical handle directly attached to the base of the shoulder; inset rim for the lid; slightly convex profile. The vase is completely filled by chains of "S" filled with small lines; a sacred tree with spiral branches is instead painted under the handles. The same motive of the body is repeated and simplified on the shoulder; this last is unusually large.

On the base of the analysis made till now, some consideration can be made regarding iconographical and stylistic features of the Prinias PGB figured vases.

It can be restated what Brock expressed in 1957, i.e., that PGB lives up to its reputation as "the most remarkable phase in Cretan vase-painting" (Brock 1957, p. 143)[3], and it can be stressed that Prinias adds more new evidence on this respect, also in considering the Knossos necropolis.

What is missing in Prinias, in comparison with the North Cemetery and Fortetsa, is the attention paid to human figures. The astonishing nature goddesses represented on both PGB pithoi from the Knossos area don't find comparison in

[3]The same in Coldstream and Catling 1996, 416.

the Prinias production. Nevertheless, a small fragment of vase found in the superficial ground, carries the image of the lower portion of a female figure, wearing a long skirt filled with chess motive. The feet are represented in profile, exactly following the compositional scheme adopted on the pithoi from Knossos and on contemporaneous figured objects largely spread in Iron Age Crete.

In general, painted decoration on PGB vases consists in mat varnish often applied on a whitish slip, following a Protogeometric tradition. The guide-shape for pottery production is undoubtfully the straight sided pithos, which just originates in the second half of ninth century to continue in the Early Geometric period, in many cases maintaining the free decoration and adoption of sinuous lines, but arranged according to a more rigid scheme, often respecting the distribution on the vase through parallel registers. Among the shapes most used in Protogeometric B, it must be mentioned even the hydria and some kinds of aryballoi and oinochoai. The latter usually present a peculiar carinated structure where, on the upper part of the shoulder, triangles, filled with lines or empty, are painted.

As for the drinking vessels, the large cup with flat base, painted through immersion, appears, slowly substituting the bell-skyphos, whereas in the very first phase both shapes live together in the same tomb J. The kalathos is also maintained, reduced in dimensions, and often used as lid for cinerary urns as the conic specimens as well (these lasts, often produced just for this purpose, recalling the decoration of the corresponding pithoi).

To the most conservative classes of material are confined the most traditional patterns, as concentric circles, inherited from the Protogeometric period. This phenomenon involves both kalathoi and kraters. The latter is particularly appreciated in Prinias, in both small and large dimensions. Probably for this reason, kraters from Prinias are particularly useful, in comparison with the ones from Knossos, in order to try to trace some sort of development of decoration.

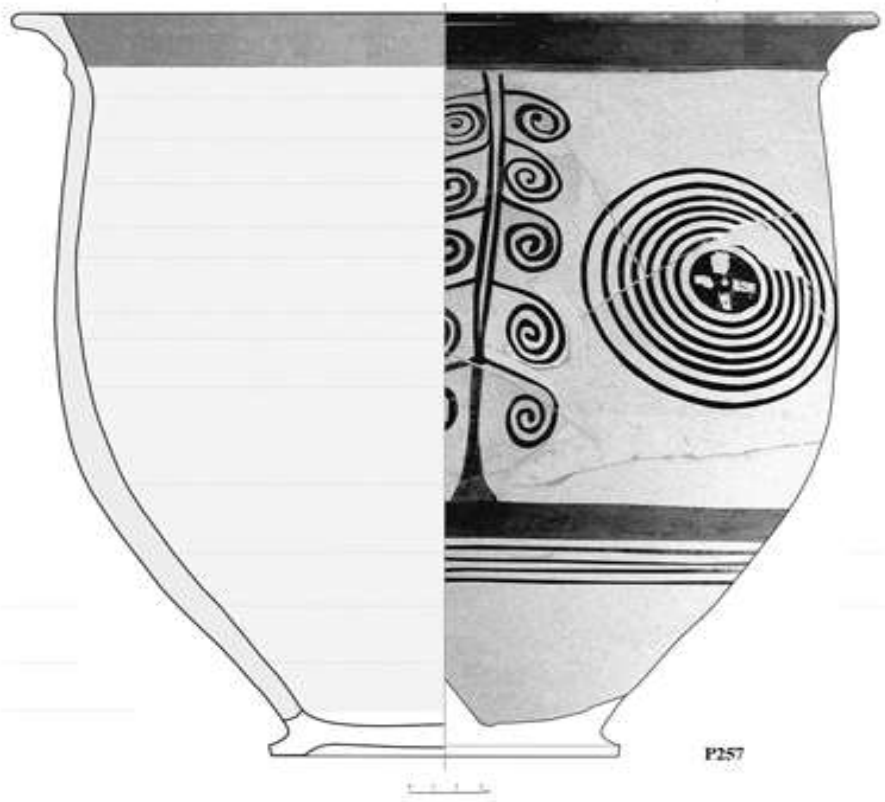
The largest specimens, indeed, still carry the canonical arrangement of wide concentric circles between handles flanking a vertical or horizontal composition made of geometric and linear motives organized and grouped to form rich decorative panels.

The smallest ones, instead, show the passage between the rigid geometric criteria on decorating vases and the more freely distributed Protogeometric B one, where, between the groups of concentric circles, now smallest and simplest, a naturalistic element is drawn.

Almost two examples of this important evidence can be detected on kraters nos. P. 257 from tomb F (see Figure 9), and p. 835 from tomb W[4].

[4]This last is not a pseudo-tholos tomb, but a pit tomb where the dead was buried into a large pithos and the pottery was placed all around it.

Figure 9. *Krater P. 257, from Tomb F*



Source: Drawing by Orazio Pulvirenti.

The first is a half preserved krater. It is characterized by an almost squat shape with quite convex profile in the lower portion and straight walls in the upper. The rim is everted and separated from the shoulder by a low, rounded rib. The circles are quite small and, differently from the Protogeometric prototypes, they are drawn more distant from the rim. At the centre of the circles, small empty crosses are placed on a dark ground. What is impressive on this specimen, is the presence of an elongated tree, resting on a solid triangle on the lower black band, with spiral branches, quite exactly recalling the trees represented on PGB contemporary straight-sided pithoi.

Tomb W was not a tholos, but a pithos burial host in a pit bounded by a wall made of regular blocks, whose entrance was emphasized by two vertical pointed stones. The tomb contained two children, whose bones were partially burned. The depositions include several miniature vases, mostly kalathoi, and small carinated PGB jugs.

Flanking the major pithos, the belly krater was deposed, its decoration consisting, as said above, in concentric circles flanking a stylised tree surmounted by a bird.

P. 835 consists in a integrally preserved vase. The shape is more squat and squared than the previous one, being the lower portion quite straight, and the upper walls quite converging. The rim is strongly everted and high. Two large groups of concentric circles decorate the main portion of the vase, their centre being filled by

a cross, as in the previous one. Even on this specimen, an elongated tree, with spiral branches, rises between the circles, on both sides, but, this time, two birds rest on it facing left. The krater is host at the Iraklion Museum and it has not been possible to analyse it macroscopically, but from the photos and drawings made at the time of the discovery it is possible to have a good general view of the specimen. On one side, the tree was clearly drawn down after the circles, and the painter had evidently to sacrifice the dimensions and correct shape of the branches in order to place the tree between them; on the other, instead, the circles are drawn down closer to the handles, so the space for the naturalistic scene is enough for the right representation of the plant. The birds are quite different from one each other, being the first completely filled with black mat paint, the second beaded by an empty band.

A third specimen of tree krater was reconstructed by me in 2015, starting from an inventoried fragment found in 1971 in the west sector of the cemetery in the superficial ground, and then associated with various sherds found in the storerooms of the Prinias mission (Pappalardo 2019, p. 464) (see Figure 10).

Figure 10. *Krater P. 476 (Prinias)*

Source: Reconstruction and Photo by Author.

Through evidence provided by the figured PGB craters it can be stated that conservative patterns, as concentric circles, are limited to the most conservative classes of material, following principles of symmetry. Nevertheless, differently from Knossos, Prinias offers the possibility to catch the very first step in adopting naturalistic decoration, as testified by the presence of trees and birds just between concentric circles.

For what concerns the large amount of figured straight-sided pithoi from the cemetery, it is evident that linear decoration is widely spread, maybe originating in the contemporaneous Geometric Attic production. Differently from continental Greece, however, Crete emerges for the use of linear decoration aimed to create and construct complex figurative scenes. Lines straight and curve are used and assembled into cables, current S, chains of lozenges, running spirals.

Additionally, the aforementioned complex motives, are used to create naturalistic figures: the body of the birds or fishes, the tree-trunks or branches, the sea vegetal are nothing but the free composition of the decorative patterns themselves, combined and mixed to create images.

The arches decorating the shoulders of straight-sided pithoi are used to create the bodies of birds or the fishes contours. Eyes, mouth, legs and tails are simply added to the combined decorative features.

With the aforementioned publication of Giovanni Rizza, the figured pottery from Prinias constituted the first significant comparison for the one found in the Fortetsa necropolis and published by Brock.

The typological homogeneity, together with the peculiar decoration, concurred in unifying the vases into a single group carrying the signature of the "Prinias Painter".

The subsequent publication of the Knossos North Cemetery, by Coldstream and Catling, considerably improved information concerning this particular phase of the Cretan Protogeometric period, and leaded to the formation of a further ceramic group, the one of the "tree painter".

With the recognition of the Protogeometric B pottery as distinct from the rest of pottery production, in Crete or in continental Greece, it has been postulated a precise chronological phase, coinciding with the second half of IX cent. And being characterized by discreet archaeological features involving several aspects of material culture. Just in this phase, then, we place a precise class of pottery production, which recognised in the strait-sided pithos the most suitable shape and identified in this peculiar figured decoration the media more opportune to convey messages about a defined group of individuals.

The analytical study of the PGB material from Prinias allowed to partially clarify some elements concerning the formation and development of this particular class of material which, at the moment, seems to place Prinias and Knossos as major centres of production, but whose presence is testified in the centre-northern region of Crete, by sites like Eltyna and Archanes, while at West by the important site of Eleutherna.

If one would try to preliminarily compare the production of Prinias with the one of Knossos, several significant differences can be detected as well as at an internal and external level, in figures rendering. The criteria adopted in rendering

birds, or trees are various and do not seem to testify the primacy of one hand on another.

Establishing the primacy of one site over the other in the elaboration of such a new style in the early Iron Age is difficult. Both centres, in fact, testify a certain skill in the experimentation of new shapes and decorations, by showing an eclectic taste, contaminated by features belonging as well as to the Minoan heritage and to the new influences coming from various parts of the Mediterranean basin, particularly active in IX cent Crete.

It rises, then, the issue of the reciprocal relationship between the corpus from Knossos and the one from Prinias, at the moment the more significant in terms of number and style.

As stratigraphic information is missing for the materials retrieved from tombs F and J, it must be attempted to trace some internal sequence based on a stylistic approach. The same criterion was adopted by Coldstream for the classification of the Knossos PGB pottery.

Results

Some differences can be detected between the two centres (Prinias and Knossos) after a first examination. In Knossos, straight-sided pithoi follow a development from more squat and stumpy shape to an increasingly slender and convex one, and the decoration evolves from a phase in which it was more freely applied, to a phase in which it was more rigidly organized in frames or registers. In Prinias the phenomenon is almost inverted: the patterns typical of PGB conceived according to the logic of the free hand drawing, independently from the tectonic of the vase, are organized into parallel register or inside frames just on those vases characterized by a squatter shape, quite convex walls and not large dimensions.

On the contrary, those pithoi of the Prinias school that show an accurate tapered shape and an elegant and sinuous profile, carry a decoration freely distributed, avoiding that organization into metopes or registers as for the more recent specimens from Knossos.

The metope housing birds on pithos P 243 from tomb F, in fact, has not the function of dividing and organizing the decoration into a geometric perspective; on contrary, it is just aimed to emphasize the subject. This last is repeated and enlarged on the vase's lower wall, freely standing on a ground of trees.

It is not easy establishing the meaning of PGB pithoi inside the largest tombs of Prinias. The easiest lecture would bring us linking their presence with social status, also in consideration of the general richness of funerary goods found inside them. But, nevertheless, we cannot exclude other exigencies at the base of this behaviour, as, for example, gender.

For what concerns the reciprocal relationships between Knossos and Prinias, the possibility of the existence of itinerant artisans, already assumed (Coldstream, Catling 1996, Kotsonas 2013), is not so much plausible.

The compositional schemes adopted by the Prinias' painters seem to maintain a proper originality, showing an use of figures different at all from the Knossian ones.

From a typological and stylistic point of view, it is evident that the figured pithoi from Prinias form a homogenous corpus.

The choice of the straight-sided pithos as cinerary urn and the experimentation of a so richly figured decoration constitute, without any doubt, a *trait d'union* between Knossos and Prinias.

Nevertheless, the variety of the decorative patterns and of the represented subjects allows to exclude that the corpus was the product of a single artisan. It seems more likely to surmise the existence of a workshop, or school operating on the wave of a stylistic current, whose characteristics had to satisfy, at a wider, or better, regional level, precise exigencies in the period of the passage from Protogeometric to the geometric in Crete.

Conclusions

The analysis carried out on the PGB assemblage from Prinias has not yet been completed. Several objects are still to be documented and chemical analysis carried out on selected specimens in order to better define clay and pigments composition.

The study, furthermore, has to be extended to the plane ware, dated to the same period and coming from the same tombs, in order to establish if we can consider Protogeometric B as an archaeological phase, involving all aspects of material culture, or, simply, a stylistic current.

Anyway, from the study till now carried out some preliminary remarks can be done.

1. The PGB straight-sided pithoi from Prinias are not dependent from the Knossian production. They follow a different development, varying their shape from a more slender with free decoration to a more squat decorated through registers according to a more geometric scheme.
2. For what concerns clay, the macroscopic observation showed that pithoi are all made with the same clay, except for the only one coming from tomb J (Figure 4) which presents a lighter, yellowish and fine composition, but very different from the one detected in the Knossos specimens (so that we can exclude an import).
3. The use of figured decoration, in Prinias, anticipate the one of Knossos, involving more conservative shapes as the kraters and being associated, in the early phase, with traditional decorative patterns, as the concentric circles.
4. At a first analysis, if compared with pottery found in the settlement, figured PGB vases seem quite exclusive of the necropolis, maybe produced just in order to be used as cinerary urns for the élites or specific groups.

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COVID-19: Cartography as a Witness of Change of Spanish Urban Models along History Due to Sanitary Crisis

By Bárbara Polo Martín[*]

During past centuries, pandemics were something very natural to the human race, but as result of industrialisation during the 19th century, they became a larger problem. The arrival of populations to big cities provoked the development of irregular and overpopulated quarters without any measures of safety, and facilitated the expansion of diseases. The problem resided in sanitation problems, as the example of what happened in London and Paris. As a solution, in different cities, and as a starting point, Paris with the Haussman's proposals, issued different reforms and extension plans were made in Spain (Nadal 2017, 357-385). Humanity believed that these extension plans would give us a healthy density and an ordered expansion. We opened big boulevards to believe that we had a wide city to walk, but nothing could be further from reality. At the beginning of 20th century, history repeated itself, and now, a new pandemic crisis has shown that cities have, again, a crisis of congestion.

Keywords: *cartography, cities, COVID-19, urban models*

Introduction

As a result of a health crisis, speculations on the conditions and perspectives of urban historical centres within the aftermath of the worldwide COVID-19 pandemic, supported different European cases. Right now, European cities are being hit by the 'second wave' of the worldwide epidemic, and are subjected to different containment strategies and measures. During last year, a range of plans have strongly impacted the economy, based, overall, on tourism in the city centres, leisure, and cultural consumption. The COVID-19 situation has had major consequences in terms of unemployment and economic depression. More extensively, the very life in city centres was highly affected, in terms of residency, mobility and access to public spaces. The previous, current and potential future use of green areas exposes a scope to rethink the paths of the economy and more-than-economic possible uses of city centres, especially when it involves new ways of connecting economy, lifestyle and citizen-led innovation.

In the unfolding of the pandemic, then, political rhetoric came to the front, building on the thought of learning from the pandemic and prospecting a replacement "urban renaissance." However, the extent to which such discourses can challenge and review pre-existing urban regimes is clearly questionable—they seem to romanticize new urban scenarios and agendas. In such a context, and within the framework of the upcoming renewal of the Leipzig Charter published in

[*]Lecturer, International University of Valencia, Spain.

the end of 2020, it is of particular interest to critically reflect on the areas, domains and potentials of the transformation of the historic centres of European cities post-pandemic. In the last two centuries we can observe in cartography a pattern that is repeated in cities: the change of their structure due to external agents. We can speak of cities of extension during the nineteenth century, to cities of pandemics, in plural.

The latest crisis, COVID-19, has allowed for pedestrianizing centres, to create cycle lanes, to increase the use of public transport, and all this, using few resources. Governments have used unique situations like that in which the city is transforming to achieve sustainable development; in places such as New York's bay after the floods (New York City Regional Heat Island Initiative 2006, United States Environmental Protection Agency 2008), New Orleans after the hurricane, Paris with population increase, or Barcelona with COVID-19.

Crises make tangible changes. They invite governments and citizens to dream, a crisis to evolve, but the citizenship has to be the main defender of these new changes, not government, as in previous occasions. The question that arises in first place is whether the temporary experiment becomes permanent in the centre. To that, we should ask, who is really in charge of this change, the governments or the citizens? Finally, we should ask ourselves as researchers if the COVID-19 crisis has acted as a real trigger for the change of urban configuration, or was it something that has been previously agreed.

Literature Review

"Public health problems were the ones that made the city to be rethought because diseases afflicted both, the rich and the poor," Richard Sennet wrote in *Build and Inhabit*. During past centuries, pandemics were something natural to societies, but as a result of the industrialization during the 19th century, they became a drag (Smith 1979). The arrival of large populations to big cities provoked the creation of irregular and overpopulated quarters without any measures of safety, and facilitated the expansion of diseases. As a consequence, the matter resided within the sanitation's problems. This situation happened, firstly, in London and Paris (Hamlin 1991, Geneviève 2007, Halliday 2013). As a solution, in several cities, and as starter point in Paris with the Haussman's proposals (Figure 1), different inner reforms and extension plans (Nadal 2017, pp. 357–385) were made. Humanity believed that these extension plans would give cities a healthy density and an ordered expansion. Governments opened with scalpel big boulevards to make us believe that we had a good city to walk.

Figure 1. *Haussman's Plan for Paris*

Source: arqui-urba.blogspot.com.

The current urban configuration in many countries is predicated on their many attempts to address health problems during the 19th century (Rodger 1996). At that point, the link between the growth of cities, and therefore the spread of disease, led some countries to adopt a replacement perspective on health risks (Hamlin 1992). For example, within the last third of the 19th century, England became the leader in terms of sanitation. Starting at that point, the mechanisms available to fight classic epidemics were reassessed, new preventive measures against transmissible diseases were adopted, a shift in focus from the environment to the people happened (Rodríguez Ocaña 1994), and different by-laws concerning health were passed in many cities. Those by-laws affected areas such as drains and sewers, street lighting, the regulation of accommodation, slaughter house activity and markets. However, these healthcare worries were taken into account early in most parts of European countries (Wohl 1983), including Spain. By the end of the 19th century, Spain was clearly a backward nation in economic, political and social terms (Capel and Tatjer, 1991). This resulted in a proposal to adopt measures and develop infrastructures already adopted in other European countries (Arnould 1902, Sussman 1997, Poligliano 1984, Hildreth 1987).

The recommended improvements were related to sanitation because of the poor state of health of the Spanish urban population (Real Consejo de Sanidad 1901, Coronas Vida 2008). The conditions in Madrid, for instance, were completely deficient, despite the extensive structure that had been administered since 1856. There have been over 3,000 cesspits within the city, while in outlying

neighbourhoods and parts of the old city, the sewers had no traps to stop the discharge of noxious fumes and nearly 4,000 homes had no direct water supply (Hauser 1913).

Meanwhile, Barcelona City Council undertook a sanitation project between 1885 and 1893. As a part of the project, the authors suggested building tanks from which water was released in order to maintain the circulation within the sewer and drain system. It was necessary because of insufficient connections to dwellings in Spain (Capel and Tatjer 1991). In 1901, a conflict broke out in Seville between the League of Householders, and therefore the council halted the construction of the latest drains within the old city (Pulido Fernández 1902). Specifically, of the seven Spanish cities with more than 100,000 inhabitants, only Zaragoza and Seville had extensive modern systems of drains, although the water system was deficient. In other cities such as Madrid, Valencia and Malaga, the land put aside water that was unusable due to the poor state of the drains. The same circumstances happened in Barcelona and Murcia. The high death rate due to infections was seen as evidence of the importance of hygiene, and the relatively large sanitation gap in Spain regarding urban organization (Hauser 1913, Pulido Fernández 1902): urgent action was required.

Figure 2. *Map of the Surroundings of the City and Project for its Improvement and Extension*

Source: Museu d'Historia de la Ciutat, Barcelona.

The sanitary enhancements were accompanied by the changes in the structure of the cities. Related to the organization problem since the middle of the century, the Spanish government approved a range of acts with the aim of regulating urban growth. As in other countries, inner reforms and extensions were the solution. Thus, in 1864, the first Population Expansion Act was approved, although it was

not applied until three years later. Its preparation was preceded by the Barcelona Expansion Plan (Figure 2). This plan was designed by Ildefons Cerdà, approved by the Central Government in 1859, and by the Minister José Posada Herrera, author of a failed project of the Reform, Sanitation and Expansion Act. All these legal and regulatory measures were inspired by the large urban planning operations carried out in Paris by Haussmann between 1851 and 1869, and in Vienna from 1857, with the Ringstrasse (Martín Ramos 1993, p. 7).

After the first Population Expansion Act, two others were published in 1876 and 1892 respectively. This last one was created specifically for Madrid and Barcelona (Martín Ramos 1993, p. 11). However, the extension model seemed to not be the only solution to enhance the situation, and, in 1895, the Extension Act was accompanied by an Internal Reform Act, which pretended to follow the Haussmann example: the opening of streets in the urban centre and downtown renovation.

In both models, Barcelona and Madrid, a series of avenues or diagonals were devised to allow rapid movement with a geometric urbanism. These neighborhoods were designed for the new capitalist bourgeoisie that saw the historic centre as not a very pleasant place to live because of its narrow streets, few amenities, little representative houses, although they still connected with it. The Cerdá's plan envisaged two large diagonals that would intersect, although the second would never be achieved. In Madrid, the diagonal that was planned would have to serve to cross the entire historic centre and connect the area of the Barrio de Salamanca with that of Argüelles-Moncloa. It was the famous Gran Vía in Madrid, where emblematic buildings such as Telefónica's quickly began to appear.

With the publication of regulatory measures at the beginning of the 20th century, some Spanish cities followed these two examples to have their own expansion projects; as was the case of Gijón (Suárez Muñiz 2018) or San Sebastián (Fernández Cuesta 2012), but these examples have remained hidden until now. This situation changed after 1924, when José Calvo Sotelo, then Director General of Administration of the political regime, implemented by General Miguel Primo de Rivera, approved the Municipal Statute and Regulations for Works, Goods and Services. Because of its approval, the municipalities with more than 10,000 inhabitants, and with a growth rate of more than 20% between 1910 and 1920, had to draw up an Extension Plan within four years. This act also led to a synthesis of the acts made relative to this issue since the end of the 19th century (Terán Troyano 1978, p. 169).

The promulgation of this provision served several purposes: Firstly, it worked as an instrument for the internal reform of the cities. Also, it allowed managing the expansion of the city to the historic centre. Thirdly, it served to plan the land's uses between the expansion and the limit of the traditional nucleus. These facts would allow the city and developers to quantify and regulate what was done in terms of expropriations, management projects, licenses, etc. (Davila Linares 1991, p. 102) According to Bassols Coma, these three perspectives formed the first complete plan on city planning in Spain (Bassols Coma 1973, 1996, pp. 53–90).

This Act, which was promulgated relatively late, supposed the explosion of urban trends that had been carried out in the rest of Europe since the beginning of

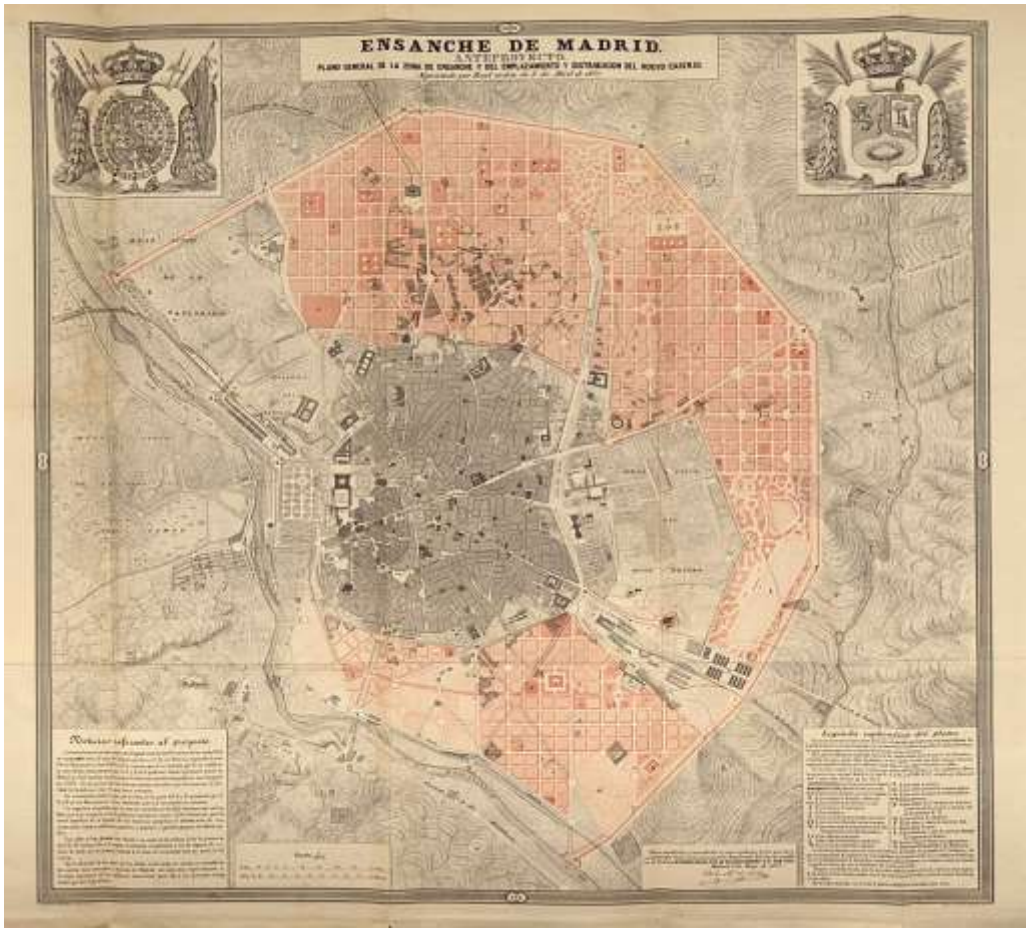
the century, characterized by rationalism and forged in international architecture conferences. The culmination of these new urban designs was the Charter of Athens, promulgated by Le Corbusier in 1933, and which contained the elementary bases to understand the reality of the contemporary city (Aymoino 1978, Hilpert 1983, Segre 1985, Le Corbusier 1959, 1996).

With the law in one hand, medium-sized cities took as models Madrid and Barcelona, but overall this last one due to its organization. The expansion of Madrid tripled the city that existed previously. The one from Barcelona multiplied it by nine or ten. In the case of Madrid, there is a clear delimitation of the limit of urban action (Figure 3). In Barcelona, it is much less defined. The one in Madrid is more of the past: it has many baroque things, like streets that do not follow the centre's streets. The one from Barcelona, on the other hand, is a much more rationalist and innovative product. Cerdà is the first to incorporate science into urban planning; for this reason it was taken as the model of Spain. Most parts of Spanish cities chose this solution, that is, the extension of the city, in which corresponds to the urban option known as expansion urbanism.

Nevertheless, in comparison with 19th century, Spanish City Councils have acted very quickly in order to enhance the welfare of their citizens; green and without-cars cities, cities for citizens and not only for the economy. Governments have known how to recover the previous state of the city and to promote spaces of quality. It is proposed that within 10 to 20 years cities are clean, green and car-free. The latest crisis, COVID-19, has allowed to pedestrianize centres, to create cycle lanes, to increase the use of public transport, and all this, only using few resources. Governments have used unique situations like that to achieve sustainable development—in cities such as New York after the floods of Sandy, New Orleans after the hurricane, Paris with population's increase, or Barcelona, Madrid or smaller Spanish cities with the COVID-19. The question that arises is whether the temporary experiment becomes permanent in the centre. Crises make tangible changes, and they invite governments and citizens to dream and evolve. The citizens have to be the main defender of these new changes, and not governments as on previous occasions.

Since COVID-19 appeared, people have begun to discuss the architecture and urban planning of the confinement. Professionals say that confinement will mean a before and after. Some experts agree that perhaps the time has come to modify the way houses are built and designed, and to also think about their interior layout. We have to find solutions so that, within them, we can also be abroad. The key is the transformation of urban structures, which is to modify and whose changes can be seen through cartography. Digital maps, in the case of Spanish cities, provide a complete view of these changes developed during this pandemic: the cease of tourism houses, development of green and pedestrian areas, enlargement of cycle lanes or exclusion of cars. It is the old view of the city, or the so-called "urban corruption" against the new one. Even among these changes, the perception about rural life, reviled by many in the face of the maelstrom of the big city, is more attractive these days.

Figure 3. *Map of the Extension Project (in red) and the Madrid`s Ville (in grey), 1860*



Source: Spanish Digital Library.

Methodology

Urban planners, builders and geographers look at the same information or problem with different perspectives. Each one analyses and joins new information in their urban studies about a problem. Taking into account the relevancy of maps to develop a new urban plan, some of them have been collected and used in this study. Also, in order to achieve the planned goals, it is proposed a thematic analysis through selection and comparison. With these sources of data, the corresponding analytic treatment was administered to get the correlations that would connect variables that ratify, or not, the working hypotheses.

The ongoing research examines the cities in different time periods and poses questions related to changes over time to these places, then put them together to provide multiple viewpoints. Time periods for urban development include 19th and 20th centuries and current conditions; these correspond to periods of growth in cities and mark times when maps or atlases are available. The application of knowledge organization and new visualization techniques provide a method for

analyzing the transformations of an urban development before, during and after COVID-19 pandemics and for posing questions about the urban changes due to a new sanitary crisis.

Discussion and Results

European cities are experiencing a 'second wave' of urban transformations due to another health crisis, COVID-19. This crisis which started in the end of 2019, subjected cities to different containment strategies and measures. Last year, such measures have strongly impacted the economic base of the historic centres of cities such as Paris, New York and Barcelona. Most of them in-part are truly associated with external agents like tourism, leisure, and cultural consumption.[5] More extensively, the very life of and in city centres was highly affected, from the point of view of residency, mobility, access to public spaces, and so on. Being enclosed in a house forces us to think about how we want the places where we live to be, and who we want to be with. Governments must find solutions so that, within them, society can also be abroad.

Searching for the answers to these questions previously exposed, create a range of different proposals in big cities in Spain, such as Barcelona or Madrid. These cities were taken into account as city models for the rest of cities in Spain before, and overall during, the pandemic. The urban proposals made by the different consistories have created an atmosphere considered environmentally-friendly, greener and sustainable, a model which differs highly from the configuration that every Spanish city has in origin.

According to the Barcelona Green Infrastructure and Biodiversity Plan created at the end of the year 2020 as a continuation of EU Biodiversity Strategy to 2020 and the strategies laid out along these lines by the UN by means of the Aichi targets for 2011-2020, some of the purposes of the city's government before the pandemic were addressed to preserve and improve the natural heritage present within the city to enable each and every one among us to profit from and enjoy. To become successful, the city hall has promoted, and currently does, different lines of action.[6]

At this point, the city's government considered this plan a vital point to strive towards a city where nature and urbanity converge and enhance each other, where green infrastructure attains connectivity and where green areas promote continuity within the natural area surrounding it. The aim is not for nature within the city to make a map of isolated spots; rather than seeking to forge a genuine network of green spaces. This greenery has been conceived as a green infrastructure forming part of the city, serving an environmental and social function. Thanks to the period

[5]https://ajuntament.barcelona.cat/turisme/sites/default/files/barcelona_tourism_for_2020.pdf https://meet.barcelona.cat/en/discover-barcelona/barcelona-today/responsible-and-sustainable-tourism

[6]https://ajuntament.barcelona.cat/ecologiaurbana/sites/default/files/Barcelona%20green%20infrastructure%20and%20biodiversity%20plan%202020.pdf https://ajuntament.barcelona.cat/superilles/es/ https://www.barcelona.cat/urbanismetactic/ca

of pandemic, the success is almost assured. Sustainability continues to be the main goal through its Agenda 21.

Consequently, this plan is another component of the general endeavours that the city is making in altogether areas. It includes air quality as well as protection of specific zones like Collserola Park, the biggest green area of the city. Barcelona City Council, and therefore the metropolitan area, implemented specific policies to enable nature to suit into the town and to reinforce biological diversity supported by the philosophy that a city with greater green infrastructure may be a city where people can benefit from higher levels of health and wellbeing (Figure 4). The city currently has the greatest number of cars per square kilometre in Europe, where pollution causes 3,500 premature deaths a year, and suffers a problem of urban heat island effect. Thanks to the crisis of COVID-19, governments have realized the problem that citizens are going through and are facing the problem regarding some solutions proposed in other cities (Solecki et al. 2005).

The pandemic has made parks event more vital. People who live close to green spaces enjoy better mental health and reduce the risk of death from COVID-19. For this reason, the Barcelona City Council changed its plan, and the current plan is now to turn one in three streets in into parks known as Pocket Parks--because of its size inside the islands (Buckle 2014)--and create 21 new public squares in order to prevent the current problem that cartography reflects: isolated spots with no continuity. Also, the Consistory is trying to promote private greenery and to open private gardens to general public in order to improve health problems.

Figure 4. *Green Areas in Barcelona*

Source: Barcelona Green Infrastructure and Biodiversity Plan. City Council of Barcelona.

Other points taken into account during the pandemic was the economy, fully

represented by tourism and, particularly, by the illegal housing. The problems regarding tourism and elevated prices started after 1990. Until that moment, the city was considered a "regular" city in Spain. However, the Olympic Games boosted the change of urbanism. The multiplication of hotels and the appropriation of part of the sea to build docks and a port made the city one of the most popular in Spain, and even Europe, to visit. For example, Barcelona has the largest port in the Mediterranean, which makes it a prime location for huge cruise ships. In 1990, around 115,000 cruise passengers came to the city. Before COVID-19, there were millions of tourists. The local government had to face mass tourism, which prevented the city to accomplish sustainable purposes.

The City Council took advantage of the COVID-19 situation to stop this, which provoked another problem: the increase in the pricing for regular citizens. Only three years before the pandemic, Airbnb provided a total of 18,817 available rooms in the city and its surroundings. Among all places, the most expensive places to rent were in the centre of the city, where there was also the largest number of tourist places (Figure 5). From that point, a range of measures were proposed in order to avoid illegal practices and normalize the prices. The City Council proposed a city for citizens and not for tourists. The plan consisted of having more inspectors, and the creation of a new municipal body of observers to detect tourists operating under the radar (Ajuntament de Barcelona 2020).

Barcelona put together both plans: the social one and the sustainable one. Following the proposed plan to become a green city, it implemented, during COVID-19, a tourism's normative relative with respect towards environment. The City Council finally got the Biosphere certification for promoting tourism that shares an environmental responsibility between visitors and residents. To have a Biosphere accreditation as a sustainable tourist destination made Barcelona rethink its urbanism.

Figure 5. *Barcelona Airbnb*

Source: IAAC.

For that reason, during the pandemic, the changes implemented in Barcelona focused on a reform of the city centre's streets. The City Council's methodology was tactical urbanism (Hartley et al. 2014, Lydon and Garcia 2015). The necessity to gain space for the community during the confinement, with the aim of enabling new walking areas to keep safety distance–because of the number of citizens it was necessary to use roads as sidewalks to avoid inner contact— led to performance through tactical urbanism. These actions were soon structured within the framework of the Super Island Barcelona Project. In other words, a plan with four crossings in pedestrian squares, and four streets in green axes, resulted in almost a total pedestrianization of the city centre. Following the example of New York–which transformed Times Square in a walking area-and San Francisco with their park-lets, Barcelona launched its proposal during the pandemic. The interventions, according to the tactical urbanism's idea, were low-cost, with low-impact, designed and executed on a small scale and, with the logic of experimentation, it is possible to ascertain and evaluate their acceptance and leads to a comparatively short time, having the ability to react if necessary by modifying the action accordingly. In this sense, Tactical Urbanism is predicated on the exercise of participatory planning, where the community has to appropriate the proposals in order that they are just materialized.[7]

The first attempts with this new methodology were made in areas not very far from the centre, and that allowed to assess if the changes would serve correctly for the purpose. The selected areas were Poblenou, Horta and Sant Antoni. After the success in these areas, the city government decided to advance the project and modify the scale and the rhythm. In order to know the possibilities of the centre, the Barcelona City Council has carried out a careful analysis of flows and mobility of citizens, neighbourhood facilities, green spaces, constructive and social fabric. A road hierarchy plan has been carried out in order to free some streets from road traffic and to create a network of green axes and squares where pedestrians have priority. One of the examples of the modifications in the city centre that could be taken into account is Carrer de Pelai—one of the main streets of the city centre. There, 1,500 square metres have been given to pedestrians and native shops and businesses. Traffic also has been reduced. The project answers to the stress of local residents and commerce and can help provide an economic boost for the centre. Tactical projects in Barcelona have transformed life through the so-called "superblocks" in Sant Antoni and Poblenou, and have increased safety in areas around schools and have provided wider pavements in Ronda de la Universitat and Via Laietana (Figure 6). Because of tactical urbanism, we have been ready to answer the challenges of the pandemic by gaining pedestrian space, creating new terraces for bars and restaurants and increasing existing ones. Despite the changes that have been made in the city centre or by "example," the City Council has planned to improve these measures in the rest of the neighbourhoods, like Sant Gervasi, Sants-Monjuic, Nous Barris…. This network allows the creation of a new map of the city in which citizens are the protagonists.

[7]https://dimad.org/di_alogos-sobre-diseno-y-urbanismo-tactico/

Figure 6. *Green Slots and Street Changes in Cerdà's Plan*

Source: Barcelona Green Infrastructure and Biodiversity Plan. City Council of Barcelona.

Nor should it is excluded that, despite being convenient actions for a sector, there's a gaggle of residents who, for various reasons, oppose the project. During this game of the affected population versus the consulted one, lies the demagoguery of power, or that of the loyalty to executive entity, within the organization of the participatory process.

In this sense, the newest interventions administered in the streets of the municipality of Barcelona, despite the looks of how of approaching the transformation following the logic of this urban practice, guided by temporary participation, rather seem to be simple obstacles to the movement of vehicles. And, during this case, the validity of the answer should be assessed, not as an intervention of Tactical Urbanism within the public space, but as a measure to avoid pollution; and, if this is the case, it should be assessed whether the traffic jam caused by poor traffic flow can cause even more pollution. This has long outraged drivers whom are polite enough to not increase pollution, this point acoustic, by honking their horns. One of the hotspots of pedestrianization is the disappearance of places for parking.

As Barcelona and Madrid, capital of Spain, has also experienced similar problems before and during the pandemic, the changes proposed have not been as relevant as the Catalan City. Madrid has a long tradition regarding greenery. To choose Madrid as capital of the reign was a very conscious decision made by King Philip II, the son of Charles V, in 1561. Part of his choice was due to geostrategic purposes, but there were other reasons as well. In addition to its central location in the centre of Spain, the most important thing was due to the passion of the Iberian monarchs for green spaces. Surrounded by oak forests and pastures, the city was an ideal hunting ground (Figure 7). This appreciation has not changed until today (Garcia-Garcia et al. 2020), but it has been affected by humankind's actions. The Community of Madrid has gone from 64,808 anthropized hectares in 1990, to 126,220 hectares in 2018. This represents a growth of 94.76%, as pointed out in different studies. In other words, artificial surfaces have doubled in less than thirty

years. The Metropolitan Region of Madrid therefore needs planning that allows a new territorial configuration. This means establishing new strategies that take into account the current ecological transition scenario (Sgobbo 2017).

Apart from the protection of green spots, other sustainable ideas have started to flourish. The City Council promotes that the beautiful wilderness should be protected at all costs, which is one of the reasons the City has formulated sustainable measures in recent years. With the local government existing before COVID-19, Madrid took its first steps in this domain. In 2018, the City Council imposed new emissions standards, as well as put a limit on travel. At the moment, 44% of the surface of Madrid is a green space.[8] This aims to further reduce the carbon footprint of the city. Currently, the city, apart from being focused on green spots or emissions, tries to improve other measures, such as the street light. Madrid is recognised by having the largest street lighting project in the world, which consists of reduction of consumption to become a smarter, more sustainable and a city for citizens.[9]

Figure 7. *Green Slots in Madrid*

Source: https://urbanmobilityindex.here.com/city/madrid/.

Nevertheless, COVID-19 has made to emerge other kinds of problems in Madrid, and, unlike the Catalan City, had used tactical urbanism in a different way. Whereas the green part is being realized, the social one has been harder to achieve. Different proposals have been made to equalize Madrid to Barcelona. The urban changes in the last years have been focused on the development of a social urbanism. The changes are centred more on unoccupied spaces than in planning policies following the rules of a citizen laboratory (Besson 2016). In other words, when money from governments runs out, citizens take over. The first example of this was La Latina, one of the neighbourhoods of Madrid, who set to figure with a

[8]https://www.imagina-madrid.es/es

[9]https://ec.europa.eu/environment/europeangreencapital/madrid-street-lighting-project/index.html

plot of land resulting from the demolition of a municipal swimming pool in Campo de Cebada. A space that initially was an empty lot, because there was no public money to try to do anything, it became a spot for citizen activities inside the heart of Madrid. After that, and following also the example of Superislands in Barcelona, Madrid stepped forward with the plan called Imagine Madrid. This project had a goal to explore new forms of intervention in urban spaces through processes of collective creation, particularly between citizens and the artistic fabric.

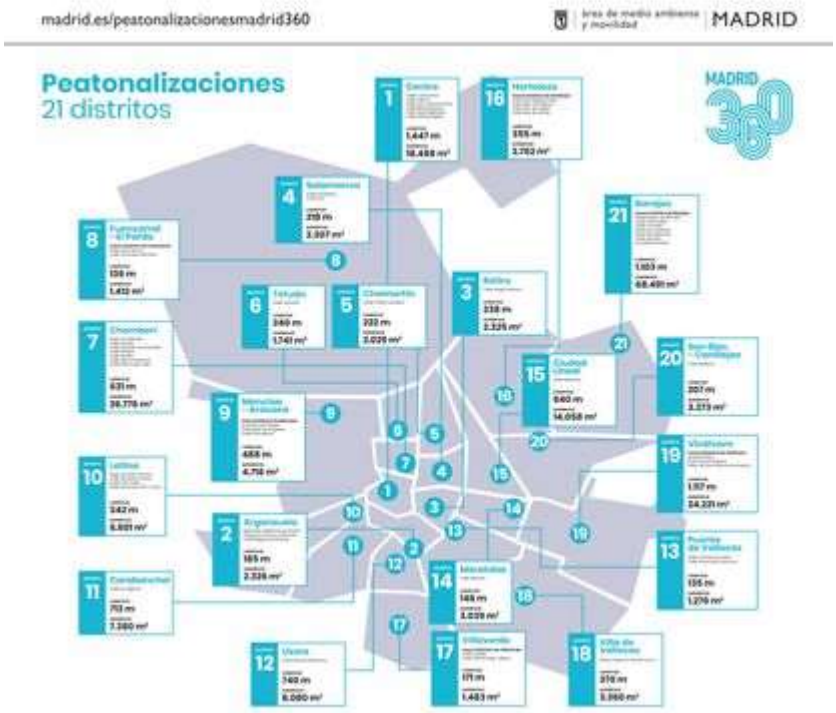
For this first call, nine spots from the surroundings of Madrid were proposed to be changed. A team of artists and creators worked in each of them. Their projects involved new ways of perceiving, narrating and inhabiting these landscapes of daily life, without forgetting the history and the identity of the neighbourhoods. The difference, in comparison to Barcelona, was that these projects looked for the connection with people's feelings. To start, during the spring and summer of 2017, the program collected the memories and feelings that the neighbours had about the nine places: Plaza Rutilio Gacís; Solar Ana María Matute; Solar de Opañel; Plaza de La Vaguada; Plaza de Valdezarza; Calle Topete; Parque de Pradolongo; Mirador Payaso Fofó and Plaza Brigadas Internacionales. Finally, each project was given to a different company, who worked directly over the place with the permission of the neighbours.

One of the examples of this campaign was the actions that took place in Rutilio García Square. Rutilio Gacía is a square away from the busiest areas of the Chopera neighbourhood. For some years, the square was the focus of neighbourhood's petitions who requested a change of use and a revitalization of the area. Sometimes this petition was crossed with proposals to exclude certain stigmatized or racial communities. In this context, the cultural project called *In tune: Rutilio Gacía*, sought from the beginning to turn the square into a place of intergenerational meetings. The purpose was to change the affections that the neighbours feel towards the square. The childhood and the knowledge of young people were the two catalysts in the programme, and from where the rest of the actions were articulated, using also the tools of mediation and community radio.

Once the experience in the surrounding areas of Madrid was checked to be a success, and COVID-19 impacted the other cities, new changes had to be made, particularly in the city centre. As in Barcelona, important roads in the centre of Madrid have definitively dismissed cars and have become pedestrianized. Streets such as Arenal, Montera or Fuencarral, previously crowded with traffic and noise, are now unimaginable spaces until not long ago, where citizens can walk quietly and forget about the bustle of fumes and engines (Figure 8). However, these pedestrianizations have been specific actions, and on occasion, they have been carried out almost without looking for them, since they arose as a result of COVID-19 that forced to cut traffic for keeping distance. Although they must be valued positively, citizenship misses a global action, as a whole, in which the mobility and coexistence model that the City Council wants for the downtown area is clear. For this reason, different proposals have been made. One of them, following the example of Barcelona, suggests the construction of a Pedestrian Island: an area where we can walk without worrying about the presence of cars

and enjoy a set of streets without their noise and smoke, as well as enjoy a greener and more humane Madrid.

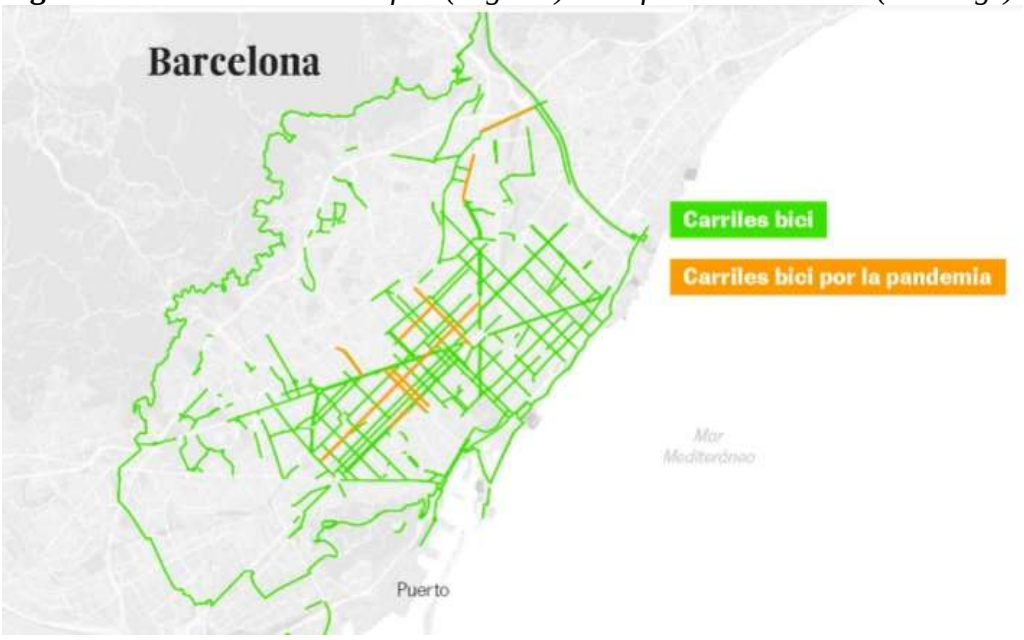
Figure 8. *Pedestrianized Streets in Madrid*



Source: Madrid City Council.

Despite this increase of the presence of pedestrians in the city centres, the most remarkable modification carried out by almost every city is the extension of cycling lanes. Walking or cycling are the only possible options to move in the centre of these big cities due to the "humanization" of them, and the reduction of cars, and, as a consequence, pollution. The commitment to cycling has been happening for years in European cities like Amsterdam, Oslo or Copenhagen, but the pandemic - and therefore the concern of citizens for health and the environment - has driven more and more capitals to follow in their footsteps. During the isolation, Berlin built 27 kilometres of temporary infrastructure (which the far right has taken to court), while London created 30 kilometres of permanent bike lanes. The mayor even promises to multiply this infrastructure by 10 by 2025 throughout the town. Brussels, whose network was 130 kilometres long, has built 40 temporary ones, with which the amount of cyclists has increased by 40%. Lisbon, which had only 105 kilometres in May, wants to double that figure by early 2021.

Figure 9. *Barcelona´s Lanes before (in green) and after the Pandemics (in orange)*



Source: El País.

Figure 10. *Madrid's Lanes before (in green) and after the Pandemics (in orange)*

Source: El País.

However, not all extensions that have been made are an equivalent. The cycling networks of the ten most populated cities in Spain, and three medium-sized cities (Valladolid, Vitoria and San Sebastián), show that in some of them (like Vitoria, Valencia, Zaragoza, San Sebastian or Seville) it is necessary to have a good network to manoeuvre around safely (Figure 11). On the other hand, other cities (like Madrid (Figure 10), Malaga, Bilbao or Las Palmas) have much less

infrastructure to manoeuvre around the urban fabric. Murcia has more bike lanes per capita than Barcelona (Figure 9), but the network of the Catalan capital is of better quality and more useful. Besides, in comparison to other Spanish cities, Barcelona has added more cycling lane kilometres during the pandemic -21 kilometres in total- in order to reach the level of the rest of European cities.

Figure 11. *Different Safety in City's Lanes*

Source: Journal El País.

All these different proposals and plans might count with the support of most of all citizens— that's the main reason to develop ways to assess their opinions about new changes, such as online surveys or an online system to send your requests to some city councils. Examples put in practice by Madrid or Barcelona have been followed by other cities in Spain.

In these cases, citizen participation has been essential to regain lost trust in institutions, politics and politicians, a true drama today in most of the countries of the world. If the eminent social character of politics is not recovered, if technocratic elitism is not overcome for the benefit of citizens, their interests and their points of view, the gap between the results of public management and social expectations about it will grow unstoppably.

Conclusion

Since the crisis of COVID-19, people have begun to discuss the architecture and urban planning of a pandemic. Professionals say that confinement will mean a strike point for societies. Some experts agree that perhaps the time has come to modify the way houses are built and designed, and to also think about their interior layout. We have to find solutions so that, within them, we can also be abroad. The transformations of urban structure in a slow way are the key to improving cities and whose changes can be seen through cartography. Digital maps, in the case of Spanish cities, provide a complete view of these changes developed during this pandemic: the cease of tourism houses, development of green and pedestrian areas, enlargement of cycle lanes or exclusion of cars. It is the old view of the city, or the so-called "urban corruption" against the new one. Even among these changes, the perception of rural life, reviled by many in the face of the maelstrom of the big city, is more attractive these days.

Experts are already beginning to consider the answers to these questions, and some cities have even begun to work on their transformation. In almost all of

them, there is a constant that we already knew: the transformation that COVID-19 will bring us will consist of accelerating the journey of cities towards sustainability, which is directly related to health.

This article has tried to provide new models of urban environments that facilitate the population's access to the healthiest options in cities. For example, policies that promote sustainable and active transportation —that is, walking or cycling— favor physical activity and reduce sedentary lifestyle, as well as enjoy lower levels of pollution. In addition, the current environment in this type of movement helps prevent the spread of the pandemic because it allows maintaining social distance.

However, despite the clear solution of sustainability, the main problem of urbanism is how to make it possible and durable for a long time. For that, Spanish experts in different fields like cartography, geography, urbanism and architecture, look for the ideal model city, in which an autonomous city and not the smart city, as it was thought lately, has a relevant role. It will be necessary to divide large cities into more-or-less autonomous pieces that are capable of responding individually to the new requirements of an overpopulated and globalized planet. All of this could only be possible together with citizens' agreement, something that consistories are taking into account through different strategies such as surveys.

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Navigating through Resilience: Young Adults in Kuwait

By Juliet Dinkha[*], Aya Abdulhadi[±], Ayshah Al-Kandari[+] & Saja Al-Obaid[‡]

Individual's behaviors, mindset and personality is greatly affected by their social circle and shaped by their past experiences, leading the individual to develop resilience against stressful situations and adversaries. Such situations are mainly experienced during adolescence stage presenting an opportunity to understand how individuals think they will react to stressful times and what measures do they consider if and when crises hit. The inevitable goal of this research is to find out how and if individuals build resilience to negative situations and find themselves to express and feel happiness instead of succumbing to negative emotions and behaviors. For a better understanding of their self-resilience, we created a framework of Internal and External Resilience to guide us with the findings. This research was conducted during the early stage of the COVID-19 spread, which did not present to be a pandemic at the time and had not affected one's life as gravely. In gathering our research, questions that will be kept in mind but are not limited to, include: how do two individuals who experience similar situations react in different ways, one left negatively affected while the other unaffected? Do past experiences make individuals more resilient to situations that they came into contact with? With those probing questions, we would be able to further understand the relationship between building resilience and experiencing hopelessness in times of crises.

Keywords: *resilience, adversaries, crises, hopelessness, psychological immune system*

Introduction

In physical science, resilience is the capacity of a strained body to recover its size and shape after some deformation caused by compressive stress (Merriam-Webster n.d.) In psychology, resilience may be thought of as the process of functioning as well or better than unstressed individuals in the face of adversity. In other words, resilience is the capacity for an individual to overcome stressful and difficult situations that may arise in life. This topic of study came about when researchers realized that there were some people who "worked well, played well, loved well, and expected well" despite major stresses (Werner and Smith 1992, p. 262). Resilience, then, requires two conditions: (1) the person must be, now or in

[*]Associate Professor, American University of Kuwait, Kuwait.
[±]Independent Researcher, Kuwait.
[+]Research Assistant, American University of Kuwait, Kuwait.
[‡]Research Assistant, American University of Kuwait, Kuwait.

the past, exposed to adversity, and (2) the person must be doing well. Resilience requires that young adults be exposed to adversity, stress, or risk. A risk factor is any individual or environmental characteristic that increases the likelihood of some negative outcome. Our research would like to uncover how individuals react to situations they are put into based on their past experiences, trauma or personal difficulties. The aim is to find out how happiness is expressed or on the contrary, how happiness is not being expressed, in individuals who have had tough pasts. Similar to the glass half full or half empty concept, we would be able to deduce if some negative situations can impact individuals in different ways.

In the article "Relationship of Resilience to Personality, Coping, and Psychiatric Symptoms in Young Adults" resilience is typically seen less in children whom have been exposed to disadvantages and trauma (Campbell-Sills et al. 2006). With regards to children exposed to traumatic experiences it has been found that when they have higher exposure to trauma they manifest higher levels of psychiatric symptoms and lower levels of resilience. The level of resilience in children and adolescents is associated with certain personality traits and characteristics they have as well as the type of coping mechanism they use to deal with stressors. In addition to one's personality and coping techniques, one's resiliency levels vary depending on how they view the world and the stressful events they experience. Whether one looks at an experience with a positive outlook or a negative outlook, the levels of their resilience will vary. Resilience is said to be higher in individuals who have close relationships with friends/family and have a positive outlook on negative situations. Whereas individuals who don't have close friends/family relationships and have a pessimistic outlook, are more prone to exhibiting less resilience when faced with adversaries.

The age of 18-25 is a crucial phase in one's life, as it is the time where individuals graduate from high school or university, or are pursuing their career. This period is filled with stress and emotional burnouts, which is why this age range is very important to study and understand how they practice resilience. According to Ong et al. (2006), one way in which resilience is practiced is through the adaptation and maintenance of positive outcomes towards stressful events (Ong et al. 2006, p. 730). As it was discovered that stressful events cause negative emotions, thus, adaptation and perseverance would invoke positive emotions. Nonetheless, resilience is found to have a contribution in the process of strengthening resistance to and recovery from stress (Ong et al. 2006, p. 731).

Literature Review

Resilience is illustrated by Gooding et al. (2012) as a protective or in other words defense mechanism for stressors (Gooding et al. 2012, p. 262). In young adults, resilience seems to be related to social support, this is understandable as at this age, people tend to create relationships and social ties outside their familial circle (Gooding et al. 2012, p. 262). According to Gooding et al. (2012) there are predictors for psychological resilience which are "emotional health and well-being, self-rated successful ageing, social contact with family and friends, optimism

and a lack of cognitive failures" (Gooding et al. 2012, pp. 262–263). Therefore, people who score low in the hopelessness scale will undoubtedly have greater resilience, as tough times would bring out their coping skills (Gooding et al. 2012, p. 262).

Nevertheless, there are protective factors that bestow resilience. Some of which are characteristics developed throughout the individual's life. According to Lereya et al. (2016) those include and are not limited to positive characteristics, self-control, empathy, intelligence, self-esteem and problem-solving skills (Lereya et al. 2016, pp. 1–2). Environments also play a huge role, such as environments both in the familial circle and outside of it, examples are functional family relationships and a supportive environment outside the family (Lereya et al. 2016, p. 2). This is important as having a support system, whether it's a family member or members or friends or teachers, can help boost an individual's confidence and the idea that they have someone to fall back onto (Lereya et al. 2016, p. 2). Functional family relationships create positive development and subsequently help them cope with stressful events (Lereya et al. 2016, p. 2). As for outside the family, a supportive environment whether it be in schools, workplace or even between friends is recognized to be a possible protective factor against stressors (Lereya et al. 2016, p. 2).

Research conducted by Oshio et al. (20013) focused on the measurement of resilience in adolescence as significant psychological and social changes occur throughout that time period and the outcome of coming into contact with those adversities will indicate factors of resilience in the individual (Oshio et al. 2003, p. 1217). They used a multitude of scales designed to assess the construct validity of the Adolescent Resilience Scale (Oshio et al. 2003, p. 1218). They hypothesized that resilient adolescent individuals (ages 19 to 23) are capable to maintain a positive mental health even after experiencing adversities and painful life experiences (Oshio et al. 2003, p. 1218). Their findings show that resilience scores did not have any connection to experiencing negative life events; however, there was a relationship between resilience and general health (Oshio et al. 2003, p. 1219). As well as, a relationship between negative life events and general health (Oshio et al. 2003, p. 1219). Their research showed that adolescent resilience score indicates features that exhibit resilience after experiencing negative events in life, which led them to conclude the validity of the Adolescent Resilience Scale (Oshio et al. 2003, p. 1221). The authors explained that further studies should be conducted to further identify information on the psychological recovery process of individuals whose features of resilience were identified through the Adolescent Resilience Scale.

Cultural

Kuwait is a very small country, located in the Arabian Gulf, and is considered to be coastal. In the old days, prior to the discovery of oil, people came from all over the Gulf and settled in Kuwait for pearl diving, fishing and trading. This has become Kuwait's trade mark, and to this day Kuwaitis take pride in this aspect of their heritage. To reiterate, Kuwait is a small-sized country and its population is

quite small as well, where the majority of people living in it are predominantly non-Kuwaitis, with almost a third of the population are Kuwaiti citizens. Citizenship in Kuwait has a great worth, people who are Kuwaiti are provided with many privileges that non-Kuwaitis do not necessarily get. Due to the importance of citizenship, only Kuwaiti males can pass down their citizenship to their children even if they married a non-Kuwaiti. While female Kuwaitis cannot pass down their citizenship to their children if they were married to a non-Kuwaiti. The reason being is that in Kuwait citizenship is considered to be more than just a document, it is deeply intertwined to the idea that one belongs to a certain family that goes way back in Kuwait's history. With the citizenship, Kuwaitis are entitled to certain societal range of privileges, which some wouldn't necessarily prefer to share with others whom are not "part of them". This sheds light on how the Kuwaiti society is shaped today.

Kuwait is based on a very close-knit society, where almost everyone knows or is related to everyone else. This is due to the way the society is structured; it is a collectivist society, where it is essential to have family as a huge part of life. In this part of the world, the entire family lives in the same house until they get married, and if they do not, they continue to live in their family home. It is believed that everyone in a family is responsible for each other, and the family reputation must remain intact as it is too is a major part of the culture in this region. The respect for family and the elderly as well is considered to be a huge factor affecting the cultural behaviors.

Modules

Understanding how one's brain leads and supports our cognitive selves through difficult times can be derived from numerous behavioral and psychology modules. These modules explain how the human brain reacts to trauma, learns from trauma and how to cope with it and with potential similar situations, with the main objective of protecting us from further trauma, thus forming coping mechanism through resilience. Such behaviors are greatly affected by the individual's outlook about life, self-belief, self-esteem and capabilities, in addition to how they perceive their role as part of their social circle. For the purpose of our study, we will be deucing the results based on the following modules:

Psychological Immune System (PIS)

Just like how our immune system defeats invading cells, we have a psychological one. Psychological immune system in other words is the mental defense system. We can define psychological immune system as "an integrated system of cognitive, motivational and behavioral personality dimensions that should provide immunity against stress, promote healthy development and serve as stress resistance resources or psychological antibodies" (Dubey and Shahi 2011, p. 37). Similarly to our immune system once our body identifies the invading cells and how to protect us from it, our brain functions in the same approach. Once our brain has experienced stress or other mental threats, our brain will know how to

deal with it in a way that does not harm us, and thus our mental health will potentially improve and help us adapt (Bóna 2014, p. 14). Our brain knows how to deal with such events through the knowledge gained from previous exposure of stressors (Bóna 2014, p. 15). Thus, our mind becomes and is adapted to better resilience post stressful event.

Biopsychosocial

Biopsychosocial is a model that illustrates how biological, psychological and social factors determine why someone acts in a certain way or suffer from a certain disorder or how they developed throughout their life. This theory indicates but is not limited to the idea that an individual's social environment, biological makeup, and psyche encourage how they would act in certain occasions. In the face of stressors, an individual's resilience is influenced by their biopsychosocial. Especially the social environment, as social environment has a huge impact on how someone deals with stressors, whether someone has a secure social environment or not, and that would influence their psychological response (Sharpe 2002).

Self-Esteem

Self-esteem can be defined as your opinion about yourself and your self-worth. One's self-esteem can come from one's experiences and interpersonal relationships with others. Just by simply saying self-esteem is a broad word, it is important to note that self-esteem has a scale spectrum. Individuals can fall on different ends on the spectrum and will have different outcomes and effects in their personal lives (Mruk 2006, p. 2). Disorders such as depression and anxiety are likely to develop in individuals who possess a low self-esteem. There is also a middle spectrum which can affect how an individual cope with failure, losses or any other problems that they may be facing (Mruk 2006, p. 2). Individuals who have higher self-esteem are more likely to believe that they can overcome any obstacle they face. They are more compassionate towards themselves and others which will in return make them capable of being resilient. Those individuals will be able to deal with stressful stressors and have the ability to problem solve and persevere through adversities.

Hypotheses

1. If individuals scale high on their hopelessness levels then that will lead to a decrease in resiliency.
2. If individuals scale high on resiliency then they would indicate better coping skills for managing stress.
3. High levels of positive emotions increases the chance for one to maintain and have resilience during stressful times.

Method

For our research we picked two set of questionnaires that would provide us with answers to our hypotheses and determine their validity. The first was the Beck Hopelessness Scale (BHS) which is a questionnaire of 20 true or false questions that was developed by Beck (1988). The questionnaire was developed for adults ages 17 and above, to measure aspects of hopelessness like having feelings about the future, loss of motivation, and expectations, to the extent of indicating suicidal attempts in depressed people (Beck 1988). Moving on to the second scale, in our research was used a 28 item questionnaire, which was developed to measure resilience in adults called "Adult Resilience Measure (RRC-ARM)" scale (The Resilience Research Centre 2016). The RRC-ARM questionnaire has different sections, each caters a certain data collection method, in our case we picked Section C option 2, that is a three-point response scale, which is an easier reading level, as the scale is administered to individuals whose primary language is Arabic. We have also used Section A from the RRC-ARM, which are some basic questions used to introduce the recipient to us, by providing a few key information about themselves, such as their nationality, gender, age and so on. This is very important, as those questions give us the advantage of knowing certain aspects about our sample, in order to be able to deduce further understanding of their behaviors.

As for the means of distributing our questionnaire, we decided to opt for a more efficient method that could reach a vast number of individuals and at a fast pace, which is by creating an electronic questionnaire using surveymonkey.com, and dispersing it electronically. A hyperlink was developed in order to easily send it out to people instead of using emails or handing out physical questionnaire papers. Once the hyperlink is clicked, participants would be directed to a landing page which displayed the survey. By following this method, we ensured that people can easily receive the hyperlink, and are able to answer the questionnaire wherever and whenever they decide to do so. In addition to this being flexible on when and where they can complete the survey, it can also be distributed by those who have already completed it and want to share it with others whom they think could complete the survey as well. One of the advantages of having an electronic survey is that once an individual has completed the survey on a specific device, they cannot attempt to take the survey again on the same device. This is due to the website being able to recognize their device's IP address, limiting individuals from answering the survey more than once.

Our survey was answered by 130 respondents, and all their data were collected by surveymonkey.com and were accessible for the research team to analyze. Utilizing some of the basic results analysis features available on the website, charts pertaining to our sample's demographics were created to support with our further understanding of the selected questionnaire results and relationship between hopelessness and resilience. The research team cross checked the automated charts created to ensure all answers received were accounted for and included in Tables 1-9.

Results

Table 1. *Age Group*

Categories	Responses (Percentage)
Under 18	2.00%
18-25	84.00%
Above 25	14.00%
Total	100%

Table 2. *Gender*

Categories	Results (Percentage)
Male	22%
Female	78%
Total	100%

Table 3. *Educational Level*

Categories	Results (Percentage)
High School Diploma	44.00%
College Degree	9.00%
Bachelor Degree	41.00%
Master Degree	6.00%
Doctorate Degree	0.00%
Total	100%

Table 4. *Household*

Categories	Results (Percentage)
Mother	17.17%
Father	8.08%
Grandparents	0.00%
Aunts/Uncles	1.01%
Cousins	0.00%
Friends	0.00%
Siblings	1.01%
Nuclear family (your parents and siblings)	68.69%
Alone	4.04%
Total	100%

Table 5. *Moving Houses*

Categories	Results (Percentage)
Once	16.16%
Twice	15.15%
Three times	6.06%
Four times	4.04%
None	58.59%
Total	100%

Table 6. *Nationality*

Categories	Results (Percentage)
Kuwaiti	76.00%
Specify if non Kuwaiti	24.00%
Total	100.00%

Table 7. *Beck Hopelessness Scale Questionnaire*

Categories	True	False
I look forward to the future with hope and enthusiasm.	84.85%	15.15%
I might as well give up because there is nothing I can do about making things better for myself.	16.00%	84.00%
When things are going badly, I am helped by knowing that they cannot stay that way forever.	84.00%	16.00%
I can't imagine what my life would be like in ten years.	68.00%	32.00%
I have enough time to accomplish the things I want to do.	70.71%	29.29%
In the future, I expect to succeed in what concerns me most.	87.88%	12.12%
My future seems dark to me.	22.22%	77.78%
I happen to be particularly lucky, and I expect to get more of the good things in life like than the average person.	63.00%	37%
I just can't get the breaks, and there is no reason I will in the future.	25.25%	74.75%
My past experiences have prepared me well for the future.	80.81%	19.19%
All I can see ahead of me is unpleasantness rather than pleasantness.	14.29%	85.71%
I don't expect to get what I really want.	48.48%	51.52%
When I look ahead to the future, I expect that I will be happier than I am now.	82.83%	17.17%
Things just won't work out the way I want them to.	41.41%	58.59%
I have great faith in the future.	76.77%	23.23%
I never get what I want, so it's foolish to want anything.	13.13%	86.87%
It's very unlikely that I will get any real satisfaction in the future.	20.20%	79.80%
The future seems vague and uncertain to me.	52.53%	47.47%
I can look forward to more good times than bad times.	88.89%	11.11%
There's no use in really trying to get anything I want because I probably won't get it.	14.29%	85.71%

Table 7 shows that the majority of respondents scored low on the hopelessness scale.

Table 8. *RRC-ARM Questionnaire*

	No	Sometimes	Yes
I have people in my life who I can respect.	1.00%	11.00%	88.00%
I share/cooperate with people around me.	2.00%	43.00%	55.00%
Getting and improving qualifications and skills is important to me.	3.00%	17.00%	80.00%
I know how to behave in different social situations (such as at work, home, or other public places).	6.00%	18.00%	76.00%
My family is supportive towards me.	8.00%	35.00%	57.00%
My family Knows a lot about me (for example, who my friends are, what I like to do).	17.00%	39.00%	44.00%
If I am hungry, I can usually get enough food to eat.	5.00%	15.00%	80.00%
I try to finish activities that I start.	2.00%	38.00%	60.00%
Spiritual beliefs are a source of strength for me (for example, believing in God or Allah).	5.00%	20.00%	75.00%
I am proud of my ethnic background (for example, I am proud of where my family comes from or know a lot about my family's history).	4.00%	17.00%	79.00%
People think that I am fun to be with.	9.00%	34.00%	57.00%
I talk to my family/partner about how I feel (for example, when I am sad or concerned).	27.00%	48.00%	25.00%
When things don't go my way, I usually fix it without hurting myself or other people (e.g., without using drugs or being violent).	7.00%	19.00%	74.00%
I feel supported by my friends.	7.00%	39.00%	54.00%
I know where to go if I need help.	14.00%	36.00%	50.00%
I feel that I belong in my community.	30.00%	35.00%	35.00%
My family cares about me when times are hard (for example, when I am ill or in trouble).	3.00%	22.00%	75.00%
My Friends cares about me when times are hard (for example, when I am ill or in trouble).	10.00%	28.00%	62.00%
I am treated fairly.	9.00%	48.00%	43.00%
I have opportunities to show others that I can act responsibly.	6.00%	28.00%	66.00%
I know what I am good at.	2.00%	35.00%	63.00%
I participate in religious activities (like going to church or mosque).	33.00%	42.00%	25.00%
I think it is important to help out in my community.	5.00%	21.00%	74.00%
I feel secure when I am with my family.	11.00%	31.00%	58.00%
I have opportunities to apply my abilities in life (like using skills, working at a job, or caring for others).	7.00%	33.00%	60.00%
I like my family's culture and the way my family celebrates things (e.g., holidays).	8.00%	35.00%	57.00%
I like my community's culture and the way my community celebrates things (e.g., holidays or festivals).	9.00%	43.00%	48.00%

Table 8 shows that the majority of respondents have access or able to tap into a support system.

Table 9. *Social Support Circle (Responses were Categorized Together based on Similarities)*

Categories	**Results (in Numbers)**
Family (including both parents, siblings, and cousins)	21
Mother	13
Father	3
Friends	18
Family and Friends	25
No one	11
Partners	2
Myself	2

Table 9 shows that the majority of respondents considered 'Family and Friends' as their primary support circle.

Discussion

The research on resilience is an ongoing discussion and has been more actively researched in the west with the outbreak of COVID-19. Studies such the ones conducted by Chen and Bonanno (2020), indicate that individuals are resilient, and this stems from several factors including previous exposure to adversary, different individual coping mechanism and access to family and community support. In discussing this study, it is important to note that similar factors were observed in studying individuals living in Kuwait. This research studied if individuals in Kuwait are capable of building up resilience to negative situations and what type of coping skills they employ to manage stress, in response to the RRC-ARM questionnaire and the Beck Hopelessness Scale (BHS) questionnaire. The results proposed a high level of resilience, leading to the creation of a framework to understand the individual's resilience through Internal and External Resilience modules, which are being presenting in this paper. For the purpose of this analysis, Internal Resilience is used to refer to how individuals are resilient, while External Resilience refers to how they think they are resilient. Both terms will form the basis to understand the results of our sample and how their responses to the RRC-ARM and BHS questionnaires correlate with resilience.

When looking at the sample at large, 76% of whom are Kuwaitis, the majority of the respondents live with their nuclear family, consisting of their parents and siblings, and since Kuwait is a collectivist society, it is expected that family members stay together until they get married, and in some cases, the males in the family remain to live with their parents and start their own family at their parent's house. Additionally, 58.59% of the sample have been living in the same house and haven't moved, which denotes a form of family stability as well and aids in raising a resilient personality, which will continue to seek social stability.

Therefore, and in response to our hypothesis (H1), individuals scored low on their hopelessness levels leading to high levels of resiliency. Whether this resiliency is truly an internal form of resilience or not, could only be dependent on the individual's experience during times of crises. About 80.81% of the sample

believe that their past experiences have prepared them well for the future. Certain stressful situations are redundant in one's life, in which previous experiences aid in how one copes with new stressful situations they are faced with. This enforces the Psychological Immune System (PIS) module, which creates 'an integrated system of cognitive, motivational and behavioral personality dimensions that should provide immunity against stress, promote healthy development and serve as stress resistance resources or psychological antibodies' (Dubey and Shahi 2011, p. 37). Thus increasing their resiliency level and belief that they are and capable of being resilient.

Based on our results (see Table 8), we can deduce that our respondents have a high resiliency and as speculated in our hypothesis (H2), this indicates that they have better coping skills for managing stress. Receiving social support from family members and understanding one's actions and consequences, capabilities and role in the community, supports the individual in being resilient in the face of advertise and increases their internal resilience. A solid support system with an open and trusted relationship with family and friends, whom individuals can count on in times of need, does create a higher sense of internal resilience.

Our sample is raised by a generation that is most likely to have had experienced the Gulf war in 1990, thus their parents must have instilled the notion of resiliency in them in order to prepare them to face stressful situations that they might encounter. Another stress-coping skill deduced from the results is intertwined with strong religious beliefs and receiving spiritual support, as agreed by 75% of our sample, leading them to cope with stressful times and overcome them with the belief of attaining a better outcome and future, thus increasing their external resilience. It is only during a stressful encounter that we could test their resilience and understand if it is also an internal form of resilience that is exhibited by individuals or not.

Additionally, violence is not considered as a first resort during stressful times, according to 74% of our respondents. This correlates with the fact that 78% of our respondents are females, and they are more likely be more considerate of their actions. The reason being is that given the collectivist nature of the Kuwaiti society, and how their actions are influenced by their social standing and family name, the females would try to maintain their families' reputation thus limit any violent acts. Other coping skills as indicated by our sample are linked to measures taken by individuals who often break on a personal and social level, and resort to measures such as crying, anger or denial to try and cope with the stressful situations they are presented with. Those individuals are more likely to present internal resilience, as they would be a better predictor of how resilient they truly are.

Our sample believes that they have acquired certain social skills and qualifications and are able to compete, grow, evolve and control their behaviors at different social situations. Being respected by family and the community, and maintaining a certain social status and stability do correlate positively with being able to stay resilient, thus proves our hypothesis (H3) to be true. It is also worth noting that positive emotions about the future self, and especially to our Kuwaiti sample, could be linked to receiving support from the government, thus feeling

safe and more hopeful, as indicated by 84.85% our respondents in Table 7. The cultural instinct is to protect its people against stressors, therefore people may see this protection as a form of self-resilience. Being certain of having a set of privileges and the rightful access to a number of essential resources including healthcare, education, finance and social support, provides a sense of a better future and creates a positive outlook, thus leading individuals to build resilience within.

Due to the nature of the privilege system in Kuwait, individuals think that they are prepared for the future. However, one could argue that they are poor predictors of their feelings as they have not experienced true resilience, therefore they think that they are resilient or able to become resilient, which is the form of external resilience. Kuwait, when compared globally, where individuals are subjected to stressors such as losing one's job, finding adequate housing, poor healthcare or unclear future endeavors and instability is experienced, individuals true self resilience is exhibited. Only then that individuals would be a more accurate predictors of their resilient self, because they have lived through a stressful situation and would be able to deduce their preparedness and ability to cope with it or not.

The contradictions in some of the results we received could be due to the responses received from the expatriates, around 24% of our sample, who do not necessarily have access to the same privilege system as Kuwaitis, but could also be based on feedback from the Kuwaitis who do not feel safe in their own home and don't trust the system in general. This hopelessness and low self-resilience is possibly experienced by those individuals who lack a strong social support system with dysfunctional family, thus losing the hope and the need to be resilient.

Conclusion and Recommendations

Most of our sample exhibited external resilience throughout the results, and this could be due to the fact that this study was conducted during the beginning of a pandemic crisis, where Kuwait was not closely touched by its repercussions. Whereas, we would expect to see more of internal resilience exhibited and a true measure of resilience as the pandemic unfolds and individuals are impacted.

There have been findings into the human Psychological Immune System which indicate the individual's ability to deal with high level of stress and trauma, as it allows the individual to focus on other positive evets which can help to facilitate the return of positive emptions (Drevitch 2020). The pandemic presented an opportunity to research this topic in a collectivist society, such as Kuwait.

As individuals are impacted by the effects of the pandemic, below are some coping mechanisms that could be effective for societies with a collectivities culture as they deal with the uncertainties of the pandemic and other high intensity adversaries.

1) **Cognitive wellness:** Individual directing their mind into getting virtual support from experts, such as teletherapy or coaching, to alter their personal

experience of the crisis and how this reflects on their self-processing of the events around them.

2) **Interconnection to self:** Individual engaging in personal hobbies and interests as a mechanism to cope with their growing anxiety levels and the challenging situation the pandemic presents them with.
3) **Media consumption:** Individual filtering the news and content related to the pandemic and what sentiments they are left with. Individual verifying and seeking positive news from official sources, and avoiding participation in the spread of rumors to support in limiting the negativity associated with its circulation.
4) **Social support:** Individual accessing their social support system, both direct and virtually, to be able to overcome the hardship through social interactions.

Limitations

The Language Used for the Questionnaire

When looking at some of the discrepancies in the results, they could be due to a number of limitations our study encountered in hindsight which are also dependent on the sample that answered our questionnaire. Language barrier could be one of the main limitations we had faced, as the questionnaires were circulated in the English language and most of the respondents' first language is Arabic. It could be that some participants may have not understood the questions correctly, thus not providing us with the correct representation of their feelings and understanding of resilience.

Fear of Confidentially Breach

A second limitation could be due to the sensitivity of the subject, and the type of the questions posed, although it was highlighted that the participation is confidential, respondents maybe have felt vulnerable to share true accounts of past experiences or to reflect on their true selves, thus not sharing accurate representations in their answers and trying to show they are better than they truly are.

The Time of Conducting the Study Outside the Spike of a Crisis

The time in which the study was conducted was during the early stages of the pandemic of COVID-19, where most respondents could have shared their hopeful perception of their resilient self, whereas as the pandemic expanded, their responses would have been actually different. If the study were conducted during the spike of the pandemic, and the respondents were actually subjected to repercussions of the situations and the radical changes which later came into effect while answering the questionnaires, we would expect the results to reflect a better measure of internal resilience as opposed to external resilience, which we believe is mainly exhibited by the respondents.

The Age of the Participants

Moreover, the current sample examined, not only that they may have not gone through stressors but they are a generation that is more stable financially and are yielding the hard work and efforts of their parents, thus they are less likely to understand what true resilience is. Our age group could have been expanded to include an older population who were more likely to have experienced stressors themselves and not only have heard of such situations from their parents or grandparents. Such stories from close social groups can influence the individual's behaviors and perceptions more likely compared to historical account of events that does not relate to the individual, however, they would not be contributing to a true resilience measure if they were not subjected to test their resilience.

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Appendix

Survey for a Research Paper

1. Age?
    a. Under 18
    b. 18-25
    c. Above 25

2. Gender?
    a. Female
    b. Male

3. What is the highest level of education you have completed?
    a. High School Diploma
    b. College Diploma
    c. Bachelor Degree
    d. Master Degree
    e. Doctorate Degree

4. Who do you live with?
    a. Mother
    b. Father
    c. Grandparents
    d. Aunts/Uncles
    e. Cousins
    f. Friends
    g. Siblings
    h. Nuclear Family (your parents and siblings)
    i. Alone

5. How many times have you moved homes in the past 5 years?
    a. Once
    b. Twice
    c. Three times
    d. Four times
    e. None

6. Please indicate who you consider to be your social support? (Text box)

7. To which of the following groups do you belong?
    a. Kuwaiti
    b. Specify if not Kuwaiti

8. Please answer the following true or false questions.
    a. I look forward to the future with hope and enthusiasm.
    b. I might as well give up because there is nothing I can do about making things better for myself.
    c. When things are going badly, I am helped by knowing that they cannot stay that way forever.
    d. I can't imagine what my life would be like in ten years.
    e. I have enough time to accomplish the things I want to do.
    f. In the future, I expect to succeed in what concerns me most.
    g. My future seems dark to me.
    h. I happen to be particularly lucky, and I expect to get more of the good things in life like than the average person.
    i. I just can't get the breaks, and there is no reason I will in the future.
    j. My past experiences have prepared me well for the future.
    k. All I can see ahead of me is unpleasantness rather than pleasantness.
    l. I don't expect to get what I really want.
    m. When I look ahead to the future, I expect that I will be happier than I am now.
    n. Things just won't work out the way I want them to.
    o. I have great faith in the future.
    p. I never get what I want, so it is foolish to want anything.
    q. It is very unlikely that I will get any real satisfaction in the future.
    r. The future seems vague and uncertain to me.
    s. I can look forward to more good times than bad times.
    t. There's no use in really trying to get anything I want because I probably won't get it.

9. Please answer the following. (Options: No, Sometimes, Yes)
    a. I have people in my life who I can respect.
    b. I share/cooperate with people around me.
    c. Getting and improving qualifications and skills is important to me.
    d. I know how to behave in different social situations (such as at work, home, or other public places).
    e. My family is supportive towards me.
    f. My family knows a lot about me (for example, who my friends are, what I like to do).
    g. If I am hungry, I can usually get enough food to eat.
    h. I try to finish activities that I start.
    i. Spiritual beliefs are a source of strength for me (for example, believing in God or Allah).
    j. I am proud of my ethnic background (for example, I am proud of where my family comes from or know a lot about my family's history).
    k. People think that I am fun to be with.
    l. I talk to my family/partner about how I feel (for example, when I am sad or concerned).

m. When things don't go my way, I usually fix it without hurting myself or other people (e.g., without using drugs or being violent).
n. I feel supported by my friends.
o. I know where to go if I need help.
p. I feel that I belong in my community.
q. My family cares about me when times are hard (for example, when I am ill or in trouble).
r. My friends care about me when times are hard (for example, when I am ill or in trouble).
s. I am treated fairly.
t. I have opportunities to show others that I can act responsibly.
u. I know what I am good at.
v. I participate in religious activities (like going to church or mosque).
w. I think it is important to help out in my community.
x. I feel secure when I am with my family.
y. I have opportunities to apply my abilities in life (like using skills, working at a job, or caring for others).
z. I like my family's culture and the way my family celebrates things (e.g., holidays).
aa. I like my community's culture and the way my community celebrates things (e.g., holidays or festivals).

10. Describe a time when someone else put pressure on you, and how you coped with it. (short answer question)

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Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic

By Tado Jurić[*]

Understanding how people react to the COVID-19 crisis, and what the consequences are of the COVID-19 pandemic is key to enable public health and other agencies to develop optimal intervention strategies. Because the timely identification of new cases of infection has proven to be the key to timely respond to the spread of infection within a particular region, we have developed a method that can detect and predict the emergence of new cases of COVID-19 at an early stage. Further, this method can give useful insights into a family's life during the pandemic and give the prediction of birth rates. The basic methodological concept of our approach is to monitor the digital trace of language searches with the Google Trends analytical tool (GT). We divided the keyword frequency for selected words giving us a search frequency index and then compared searches with official statistics to prove the significations of results. 1) Google Trends tools are suitable for predicting the emergence of new COVID-19 cases in Croatia. The data collected by this method correlate with official data. In Croatia search activities using GT for terms such as "PCR +COVID", and symptoms "cough + corona", "pneumonia + corona"; "muscle pain + corona" correlate strongly with officially reported cases of the disease. 2) The method also shows effects on family life, increase in stress, and domestic violence. 3) Birth rate in 2021 will be just 87% of what it would be "a normal year" in Croatia. 4) This tool can give useful insights into domestic violence. Unquestionably, there are still significant open methodological issues and the questionable integrity of the data obtained using this source. The fact is also a problem that GT does not provide data on which population was sampled or how it was structured. Although these open-ended issues pose serious challenges for making clear estimates, statistics offer a range of tools available to deal with imperfect data as well as to develop controls that take data quality into account. All these insights show that GT has the potential to capture attitudes in the broad spectrum of family life themes. The benefit of this method is reliable estimates that can enable public health officials to prepare and better respond to the possible return of a pandemic in certain parts of the country and the need for responses to protect family well-being.

Keywords: *Google trends, COVID-19, birth rates, domestic violence, Croatia, predicting demographic trends, family*

[*]Assistant Professor, Catholic University of Croatia, Croatia.

Introduction

In the absence of medical treatment and vaccination, the mitigation and containment of the ongoing COVID-19 pandemic rely on behavioural changes. Timely data on attitudes and behaviours are thus necessary to develop optimal intervention strategies and to assess the consequences of the pandemic (Perotta et al. 2020). A key problem is a lack of data to assess people's and thus family's behaviour and reactions to epidemics. Decision-making and the evaluation of non-pharmaceutical interventions require specific, reliable, and timely data not only about infections but also about human and family behaviour. We seek to narrow this data gap by monitoring individual and family behaviours in response to the COVID-19 pandemic in Croatia. We used Croatia as a case study because the country is an extremely interesting case of studying the consequences of the pandemic on family life. After all, it was the first EU member state, to experience two strong earthquakes (March and December 2020; SSOC 2020a, 2020b), in addition to the pandemic. This further affected the spread of the pandemic and increased risk factors in families and which increased death rates. Furthermore, there are no studies of this type (digital demography) in Croatia and the wider region of Southeast Europe. When it comes to the use of the Internet, Croatia is generally comparable to the EU average so the results of this study can be compared with other EU countries. Here it is important to briefly mention that Google search engine is the most popular search engine in Croatia, preferred by 97.21% of users (StatCounter 2020), similar to EU level (92.92%; Jurić 2021b, d).

The COVID-19 outbreak and lockdown accelerated the adoption of digital solutions at an unprecedented pace, creating unforeseen opportunities for scaling up alternative approaches to social science (Hantrais and Lenihan 2021). We will show that GT has the potential to capture attitudes in the broad spectrum of family life themes. These insights can be very useful to understand and predict some behaviours in the field of public health and for monitoring families but also for predicting new COVID-19 cases in a specific area. The basic methodological concept of our approach is to monitor the digital trace of language searches with the Google Trends analytical tool[1].

After briefly showing the results of relevant studies in digital demography in the next section, in section 3 we will give a brief overview of the spread of coronavirus in Croatia. This overview is important for the comparison of results that we received with GT with official results. The next section shows how this method can predict the increase in new cases of infection in a particular region promptly and enable the public offices to act accordingly with additional measures. Then, we show how GT can be used as a method to predict the socio-psychological impact of the pandemic in Croatia on families and growth indicators of domestic violence during the pandemic in Croatia. We end the article with Google Trends indicators about the consequences of the COVID-19 pandemic on the fertility rate in Croatia in the year 2021.

[1]trends.google.com.

Although previous research in this area has shown the feasibility of using digital data for demography (Zagheni et al. 2017, Jurić 2021b, d), it is unquestionable that there are still significant open methodological issues and the questionable integrity of the data obtained using this source (see Cesare et al. 2018), which we will discuss in more detail in the section methodology.

How Analysing Google Searches can Support COVID-19 Research

Online searching is often where people come to get answers on health and wellbeing, whether it's to find a doctor or treatment center or understand a symptom better just before a doctor's visit (Gabrilovich 2020). The pandemic accelerated the uptake of digital solutions in data collection techniques (Sogomonjan 2020). Livingstone (2020) portrayed digital technologies being harnessed to support public health responses to COVID-19 worldwide. In the short term, face-to-face survey interviews were replaced by online interviewing, and by turning to other data sources. This direction of travel had to be abruptly scaled up as it became the "new normal" for data collection and dissemination (Hantrais et al. 2020). Artificial intelligence (AI) correctly predicted the spread of COVID-19 before anybody else (Niiler 2020). AI was used extensively and in various forms in the context of COVID-19 (COE 2020). AI applications were introduced to track the pandemic in real-time, to predict accurately where the virus might appear next, and to facilitate the development of an effective vaccine (Sogomonjan 2020). AI was capable of processing vast amounts of unstructured text data to predict the number of potential new cases by area (Vaishya et al. 2020) and to forecast which types of populations would be most at risk, while also assessing, evaluating, and optimizing strategies for controlling the spread of the epidemic (Kritikos 2020).

In the past, researchers have used Google Search data (in the USA, Germany, Italy, etc.) to gauge the health impact of heatwaves, improve prediction models for influenza-like illnesses, and monitor Lyme disease incidence (Gabrilovich 2020). Google Trends makes available a dataset of search trends for researchers to study the link between symptom-related searches and the spread of COVID-19 with the aim of a better understanding of the pandemic's impact[2]. According to Fox (2006) and Ginsberg et al. (2009), web search queries are a uniquely valuable source of information about health trends. A set of Yahoo search queries containing the words "flu" or "influenza" were found to correlate with virologic and mortality surveillance data over multiple years (Polgreen et al. 2008). According to Bousquet et al. (2017), GT may predict the outbreak of many diseases. In Germany, correlations between the patient-based, combined symptom medication score (allergy) and GT data are stronger than those with the regionally measured pollen count data (Konig and Mosges 2014; see Marques et al. 2016). Google search interests can also be used to predict the number of asthma-related emergency department visits in the area (Ram et al. 2015, Bousquet et al. 2017). The project by Google Trends, Schema, and Axios shows how searches became

[2]See searchingCOVID19.com/ 2020.

more specific as infections of COVID-19 spread across the United States (Kight 2020).

By looking at Google Trends search data related to the COVID-19 pandemic, we can discover patterns in our desire for information - waves of interest that reflect the pandemic's progression and our understanding of it. Researchers could use this dataset to study if search trends can provide an earlier and more accurate indication of the re-emergence of the virus in different parts of the country, but they also can be useful in studying the secondary health effects of the pandemic (Gabrilovich 2020). Ferguson et al. (2005) show that early detection of disease activity when followed by a rapid response, can reduce the impact of both seasonal and pandemic influenza.

This method has proven to be very useful for gaining insight into several other fields of research, such as the consequences that a pandemic and the measures associated with it have on the mental health of the population (see results). The restrictions to movements, events, and relations left serious consequences on the mental health of many individuals and family lives (Bruno 2020). In the short term, while protecting vulnerable individuals (the frail and the older adult) from the epidemic, they increase the risks of loneliness and therefore mental health issues (Hossain et al. 2020).

Previous studies have shown that public health emergencies may affect health, safety, and well-being. These effects may translate into a range of emotional reactions (such as distress or psychiatric conditions), and unhealthy behaviors (such as excessive substance use) (Pfefferbaum and North 2020). Uncertain prognoses, personal freedoms, large and growing financial losses, and conflicting messages from authorities are among the major stressors that will undoubtedly contribute to widespread emotional distress and increased risk for psychiatric illness associated with COVID-19 (Pfefferbaum and North 2020). Much of these results, although they were made predominantly in the USA, applies also to Croatia. During the first half of 2020, 37% more misdemeanors and as much as 57% more criminal offenses were recorded in Croatia than in the same period in 2019. The Ombudsman Office of the Gender Equality in Croatia states that during the isolation due to the pandemic, it recorded an increased number of complaints of domestic and partner violence[3].

Historically, economic crises have never been the preferred period for a couple to decide to have a baby (Matysiak et al. 2020). The results of Luppi et al. (2020) show that fertility plans have been negatively revised in all countries, but not in the same way. According to our method, in Croatia, the birth rate in 2021 will be just 87% of what it would be "a normal year".

The share of Internet users has increased significantly since 2009 when the first studies of this type were conducted, so the insights that can be obtained in this way are today much more reliable. By mid-2020, 58% of the world population was estimated to be internet users, compared to almost 90% in the European Union (StatCounter 2020, Jurić 2021b). Within the EU, the same study showed that usage ranged from nearly 98% in Denmark to less than 70% in Bulgaria - in

[3]Gender Equality Ombudsman Croatia 2020.

Croatia (81%) (Eurostat 2020)[4]. Eurostat data show that 19% of citizens in Croatia have never used the Internet, while the EU average is 11% (Eurostat 2020, Jurić 2021b). According to data from the Central Bureau of Statistics (DZS) from 2019, 82% of households in Croatia have access to the Internet. The data show that when it comes to the use of the Internet, Croatia is generally comparable to the EU average. As the age increases, so does the percentage of citizens without any experience in using the Internet. That is most people who do not use the Internet come from the group over the age of 65, as many as 62% of them. The reasons for not using the Internet in Croatia are mainly reduced to a larger share of the older, less educated, and poorer population. This is certainly a serious limiting factor for all studies of this type, and care should be taken that almost one-fifth of the population fails to be included in such sampling.

Schwab and Malleret (2020) argued that the world today is "facing a 'defining moment' as the pandemic precipitated the fusion of technologies, enabling digital technologies to extend their reach, almost uncontrolled, into every aspect of life. Building on the third digital revolution, the Fourth Industrial Revolution is distinguished from previous industrial revolutions by its 'velocity, scope, and systems impact'. This Fourth Industrial Revolution would develop exponentially rather than linearly and would 'fundamentally alter the way we live, work, and relate to one another" (Schwab, Malleret 2020). At the micro-level, families are shown to have become "digital by default" (Livingstone 2020). Among other indicators in Croatia, this is reflected in the fact that the top three searches in 2020 were related to the growth of interest in applications such as Google Classroom, Zoom, Office 365 for schools (Google Year in Search 2020).

To select the most common terms in our study to be searched, we adhered to WHO (2020a, b) and Croatia official statistics[5]. Infected with COVID-19 may be asymptomatic or develop symptoms such as fever, cough, fatigue, shortness of breath, or muscle aches. A review of 55,924 laboratory-confirmed cases in China showed the following typical signs and symptoms: fever (87.9% of cases), dry cough (67.7%), fatigue (38.1%), sputum production (33.4%), shortness of breath (18.6%), sore throat (13.9%), headache (13.6%), muscle pain or joint pain (14.8%), chills (11.4%), nausea or vomiting (5.0%), nasal congestion (4.8%), diarrhoea (3.7%), haemoptysis (0.9%) and conjunctival congestion (0.8%) (WHO 2020). In Croatia by the onset of the epidemic, we have noticed a sharp increase in searches for several topics related to COVID-19 like "PCR + COVID", "cough + corona"; "pneumonia + corona"; "dry cough + corona"; "runny nose + coronavirus"; "muscle pain + corona", "anxiety + depression", "abortion pill", etc. Based on these findings, we checked whether the tool can be used for monitoring and predicting new COVID-19 cases and whether this method can be useful in monitoring families.

[4]https://ec.europa.eu/eurostat/statisticsexplained/index.php?title=Digital_economyand_society_statistics_-_households_and_individuals/hr. [Accessed 20 February 2021]
[5]koronavirus.hr.

Methodological Explanation

The basic methodological concept of our approach is to monitor the digital trace of language searches with the Google Trends analytical tool (trends.google.com). The GT analytics application is a trend search tool that shows the popularity of a term when searching on Google, and we can see if a trend is rising or falling. GT does not provide information on the actual number of keyword searches. Instead, it standardizes search volume on a scale of 0 to 100 over the period being examined (see Jurić 2021a, b, c, d) with higher values indicating the time when the search volume was greatest, allowing for verifiable metrics[6].

To standardize the data, we requested the data for the period from 20 January 2020 to 20 December 2020 (in case of predicting of new COVID-19 cases from 20 January 2020 to February 2021). When we deemed it necessary, we also collected data for longer periods (which is indicated below each figure). We then divided the keyword frequency for selected words giving us a search frequency index. We have then compared searches with official statistics to prove the significations of results (see further explanations by Wilde et al. 2020).

Further, keywords were chosen by brainstorming possible words that we believed to be predictive, specific, and common enough for use in forecasting (we used a similar method in predicting migration from Croatia; see Jurić 2021b, c). After the significance screen, we selected keywords and topics.

Table 1. *Keyword and Topic Selection Criteria*

Symptoms	What is/How to?	Terms	Activities
Asthma	What is coronavirus?	Influenza Complication	Coronavirus testing
Anosmia	What is Zoom?	Cold/Flu Remedy	PCR test
Common cold	How to make a face mask?	General Influenza Symptoms	Application for a minimum wage
Cough	How to make hand sanitizer?	Term for Influenza	
Depression		Symptoms of an Influenza Complication	
Fatigue		Antibiotic Medication	
Fever		Remedies for corona	
Headache		General Influenza	
Nausea		Antiviral Medication	
Shortness of breath			

To understand these terms, a note on the logic behind the Google Trends search algorithm is necessary. Certain delimiters, such as ", -, and + allow users to

[6]trends.google.com.

change the combinations of keywords searched. A search for a single keyword will yield the search frequency index counting all searches containing that keyword, including searches that contain other words (Wilde et al. 2020).

Limitations

The study we present, as well as all other studies of this type, has important limitations that we want to highlight (see Jurić 2021b). Although previous research in this area has shown the feasibility of using digital data for demography, at the same time we highlight the problems associated with assessments and conclusions (see Zagheni et al. 2017, Zhang et al. 2020, Jurić 2021b, d). Namely, it is unquestionable that there are still significant open methodological issues and the questionable integrity of the data obtained using the sources of large data sets. Unquestionably, this model has unresolved issues related to the reproducibility of the findings and the validity of the measurements, which arise from the very characteristics of the Google Trends (GT) system used (see Jurić 2021a, b). When using this tool it should be borne in mind that each of these searches was conducted for its reason and does not answer direct questions from researchers. Thus, for example, "googling" the term "coronavirus testing" is not necessarily an implication that someone is ill or experiencing symptoms. The search queries are not exclusively submitted by users who are experiencing COVID-19 symptoms, and the correlations we observe are only meaningful across large populations. However, testing of a similar model used in the U.S. for the onset of influenza showed a high correlation between influenza symptom searches and physical reports of influenza cases (Ginsberg et al. 2009).

The fact is also a problem that GT does not provide data on which population was sampled or how it was structured (Jurić 2021d). Despite strong correlations, this system remains susceptible to false alerts. An unusual event, such as a drug recall for a popular cold or flu remedy, could cause such a false alert (Ginsberg et al. 2009). In Croatia, such an example was observed after complications with vaccination with Astra Zeneca, when interest in vaccination and vaccine types increased sharply. Although these open-ended issues pose serious challenges for making clear estimates, statistics offer a range of tools available to deal with imperfect data as well as to develop controls that take data quality into account (see "R"; see Zagheni et al. 2017). Those problems can be resolved also by triangulation. In results, we show, for example, that the increase in Google search is correlated with the increase in the number of new COVID-19 cases recorded by official statistics and that the decrease in Google search is correlated with the decrease in the number of new cases recorded by official statistics.

The Google search Index cannot estimate the exact number of searches, so with the help of this tool the exact number of new cases cannot be estimated, but the increase of the trend can be noticed very precisely (see Jurić 2021a, b), which can serve as an indicator of new cases in the whole country and individual regions. We tested the method in the Croatia case by comparing the findings obtained with GT with official indicators. We show that the increase in Google search is correlated with the increase in the number of new COVID-19 cases recorded by

official statistics and that the decrease in Google search is correlated with the decrease in the number of new cases recorded by official statistics. A particular limitation of this approach is the fact that the demographic characteristics of users cannot be determined, which plays an important role in the context of the suppression of the spread of the infection. The main advantage of this approach compared to official indicators is that it detects the phenomenon as quickly as possible and thus can serve as an early alarm. This is relevant for family life because it has been observed that the virus spreads particularly rapidly in households where more young and old people live together (Esteve et al. 2020). Namely, younger people are more often asymptomatic patients or do not feel great health problems due to infection, which is why they are often unaware that they are infected, and as such represents an extremely great danger for older members of the household. With the early detection of the spread of the virus in certain parts of the country, measures such as closing cafes, clubs, switching to online classes, etc. can be introduced quickly to take preventive action.

The demographic structure of the country plays an important role in understanding the spread of the infection. Luppi et al. (2020) in their study about the impact of COVID-19 on fertility plans suggest that the possible effect of the COVID-19 epidemic and the subsequent economic crisis cannot be merely interpreted under the same mechanisms in all European countries. Esteve et al. (2020) show the double challenge that countries such as Greece, Italy, Portugal, and Spain face: the combination of an aged population with inter-generational residence leads to high estimated death rates due to COVID-19 but also makes preventing deaths due to within-household transmission of the virus particularly challenging. Evidence shows that the risk of severe disease and mortality increases sharply with age (WHO 2020). "Therefore, the age structure of the population - what proportion are young or old - and the structure of co-residency - how big are households and how old are their members - are two key factors that determine the vulnerability of countries to outbreaks of COVID-19, and how effective general and age-specific household confinement policies can be in reducing mortality after an outbreak" (Dowd et al. 2020). As the virus can be transmitted outside and within households, the effects of such measures will depend on the number of transmissions that take place outside and within the household (Esteve et al. 2020).

Preventing primary infections among the elderly is the most effective in countries with small households and little intergenerational co-residence such as France, whereas confining younger age groups can have a greater impact in countries with large and inter-generational households such as Bangladesh (Esteve et al. 2020). According to this study, Croatia can be classified as a country that shows the characteristics of the spread of infection as in southern Europe[7]. Whereas such studies have not been carried out in Croatia, but the lifestyle in the coastal part of Croatia is very similar to the Italian one, Italian case can suggest how to identify contexts and populations that are particularly vulnerable to aging-sensitive epidemics also in the Croatian case (see Balbo et al. 2020). Those countries are characterized by a higher share of intergenerational co-residence and

[7]See koronavirus.hr.

contacts among generations, i.e., "strong" family ties. While culture plays a role in shaping these differences, also structural factors are relevant (Balbo et al. 2020). While in "normal" times strong family ties are protective for older adults, they become a risk factor during epidemics, and aging-sensitive epidemics in particular (Balbo et al. 2020).

Occurrence and Spread of Coronavirus in Croatia

The first case of SARS-CoV-2 virus infection in Croatia was confirmed on February 25, 2020[8]. One year later, there were 237,725 patients in Croatia. On March 11, 2020, a decision was made in Croatia to declare an epidemic of the COVID-19 disease caused by the virus[9]. On March 22, 2020, Croatia was hit by an earthquake measuring 5.5 on the Richter scale[10], which is the strongest earthquake in Zagreb after the 1880 earthquake. It is assumed that the consequences caused by the earthquake contributed to the behaviours that contributed to the increase in the number of newly infected in the coming period[11].

On April 2, more than 1,000 infections were recorded in Croatia. Due to the increase in the number of patients per 100,000 inhabitants, Croatia was placed at the end of August on the red list of a total of 13 EU countries. The increase in mortality began at the end of August, in mid-October, the death toll rose sharply, and in December Croatia was in fourth place in Europe with a 57% mortality surplus compared to the average of the last five years. Only Slovenia, Lithuania, and Bulgaria had higher mortality rates[12]. Two effects affected mortality - the premature death of many individuals who would still live without the virus, and the virus hastened the death of those nearing the end of their lives. In Croatia, COVID-19 in 2020 was the fourth leading cause of death in women and the third in men. Men had a two to three times higher risk of death from COVID in older age groups than women[13].

Due to the dramatic increase, the government has announced new strict measures to combat the epidemic[14]. Measures that affected families were school closures, a ban on visits to nursing homes, and extended confinement of the elderly in their homes. As in other countries, there have been debates about the role that specific age groups, and particularly children, play in the transmission of the virus (see Zimmerman and Curtis 2020).

Most infected were in the north, in Međimurje County, about 10%[15]. This fact is important to us because the GT also shows that the search for the mentioned terms was the largest in this region, weeks before the pandemic spread. Since mid-December, the situation has improved significantly and there are fewer active and

[8]koronavirus.hr.
[9]zdravlje.hr 2020.
[10]pmf.unizg.hr 2020.
[11]koronavirus, hr, 2020.
[12]ourworldindata.org, 2021.
[13]Čipin 2021.
[14]Civilna-zastita.gov.hr 2020.
[15]koronavirus.hr 2020.

new cases every day. In the next part of the year, the situation changed, and by January 2021, with just over 1,000 registered cases per million inhabitants, Croatia recorded data like most other countries in the EU[16].

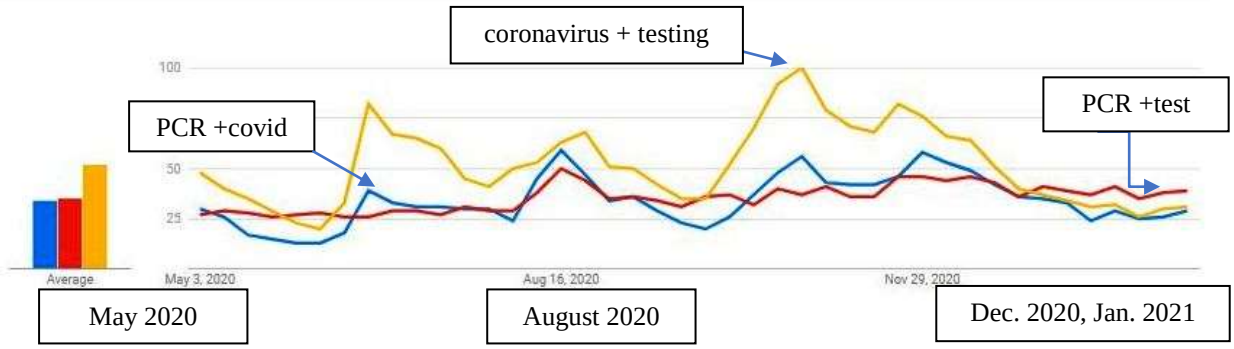
In the first 400,000 people infected with coronavirus, a total of 257 patients died[17]. In the 2020 pandemic year, Croatia has the highest number of deaths since the civil records of deaths and excess mortality were monitored, especially during November and December 2020[18]. According to preliminary estimates in 2020, 56,677 people died (DZS 2021). At the end of 2020 and the beginning of 2021, there was a strong fall in the number of deaths due to pandemics and newly registered cases of infection. In the next section, we show the results obtained with Google Trends.

Results

Google Trends as a Method to Predict New COVID-19 Cases

With the outbreak of pandemic in Croatia and lockdown in March 2020 Croatian citizens are beginning to google intensively for terms related to COVID-19. We checked the most COVID-19 related queries in Croatia and here we highlight the queries that showed the highest correlation with official indicators.

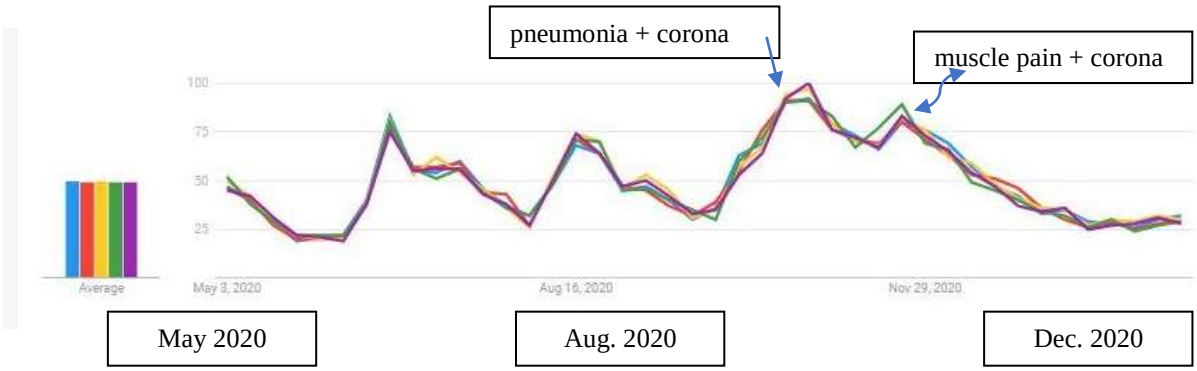
Figure 1. *Queries Reported by GT Concerning Queries "PCR +COVID", "PCR + Test" and "Coronavirus + Testing" from May 2020 to February 2021 in Croatia*



It is confirmed that the Increase in Google search queries "PCR +COVID", "PCR + test" and "coronavirus + testing" is correlated with the increase in the number of new cases (Figure 1). The decrease in Google search is correlated with the decrease in the number of new cases (see below R^2).

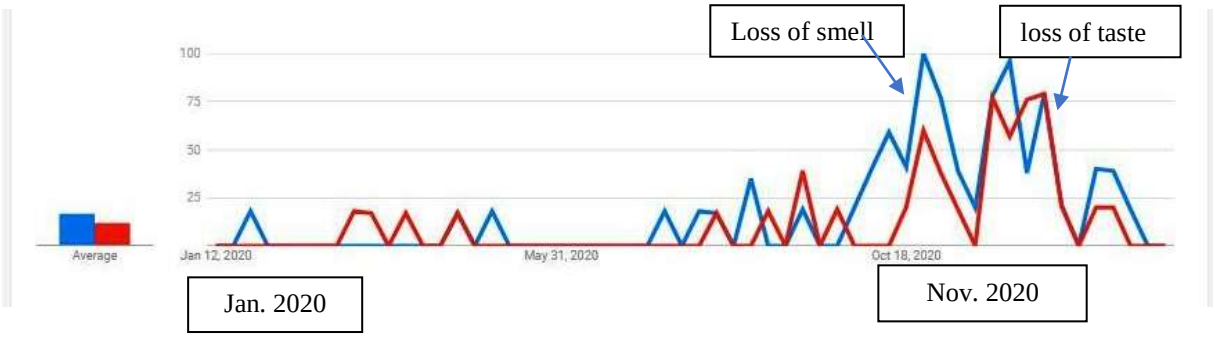
[16]koronavirus.hr 2021.
[17]koronavirus.hr 2021.
[18]Čipin 2021.

Figure 2. *Queries Reported by GT Concerning Symptoms "Cough + Corona"; "Pneumonia + Corona"; "Dry Cough + Corona"; "Runny Nose + Coronavirus"; "Muscle Pain + Corona" from May 2020 to February 2021 in Croatia*



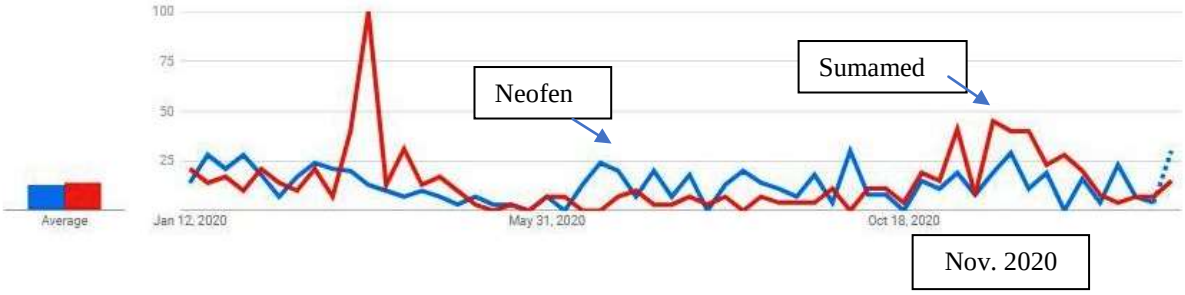
It is confirmed that the increase in Google search queries "cough + corona"; "pneumonia + corona"; "dry cough + corona"; "runny nose + coronavirus"; "muscle pain + corona" is correlated with the increase in the number of new cases (Figure 2). The decrease in Google search is correlated with the decrease in the number of new cases (see further proceedings in continuation).

Figure 3. *Queries Reported by GT Concerning "Loss of Smell" and "Loss of Taste" from January 2020 to February 2021 in Croatia*



It is also confirmed that the Increase in Google search queries "loss of smell" and "loss of taste" is correlated with the increase in the number of new cases. The decrease in Google search is correlated with the decrease in the number of new cases (Figure 3).

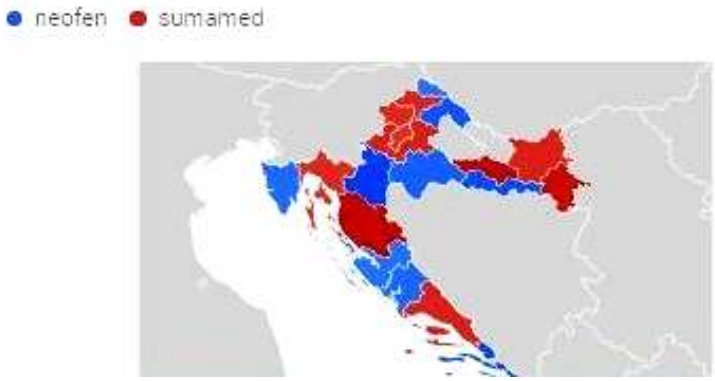
Figure 4. *Queries Reported by GT Concerning "Neofen" (Medication) and "Sumamed" (Cro. Most Popular Antibiotic) from January 2020 to February 2021 in Croatia*



We have also researched whether the use of recommended drugs increased - "Neofen" (medication for fever) and "Sumamed" (Cro. most popular antibiotic). It can be seen in Figure 4 that the demand for these drugs increased especially at the time of the pandemic outbreak and in the fall of 2020 when the largest number of new cases was recorded.

Google search interests can also be used to predict the number of COVID-19-related emergency department visits in the area. The regions in which these terms were searched recorded the largest increase in the number of new cases a week later.

Figure 5. *Correlation by Regions*

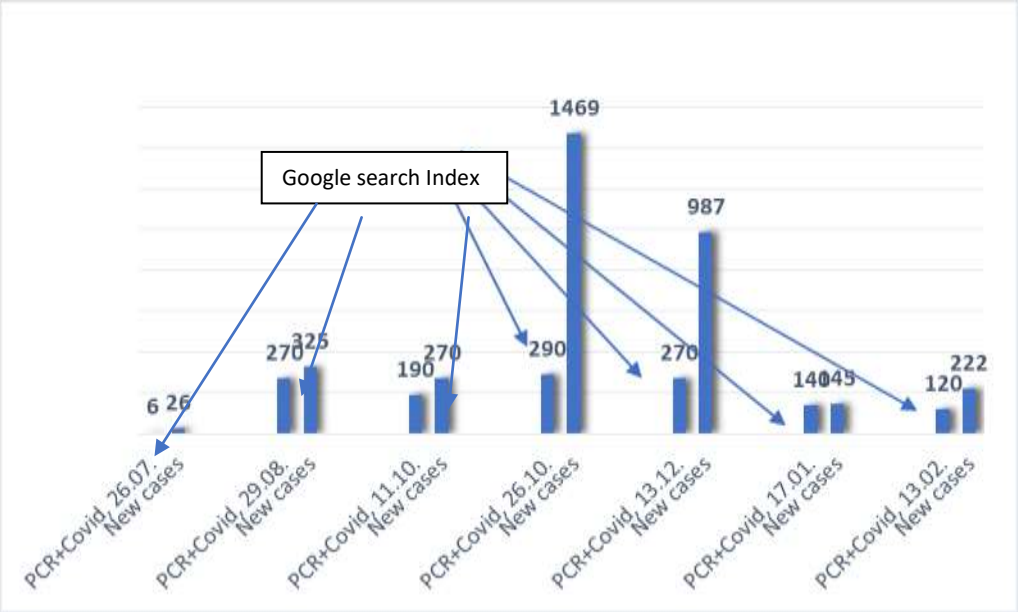


The search for these drugs correlates with a sharp increase in the number of new cases in November 2020 in the northern Croatian regions (Figure 5)[19].

In further proceedings to standardize the data, we requested the data for the period from January 2020 to 20 February 2021 and divided the keyword frequency for each word (see Table 1) giving us a search frequency index. Then we have compared searches with official statistics to prove the significations of results (see HZJZ.hr). We especially focused on the so-called second wave of infection spread when cases began to grow exponentially.

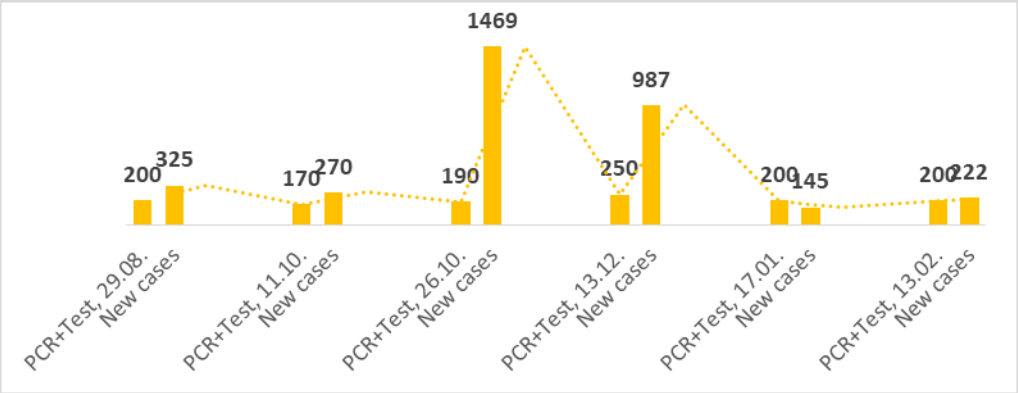
[19]Novi list.hr 2020.

Figure 6. *Correlation between Google Search Index for Query "PCR +COVID" and the Official Number of Reported New Cases of COVID-19 Patients in Croatia by Selected Dates 2020 and 2021*



The graph in Figure 6 shows that the increase in Google search is correlated with the increase in the number of new cases and that the decrease in Google search is correlated with the decrease in the number of new cases.

Figure 7. *Correlation between Google Search Index for Query "PCR +Test" and the Official Number of Reported New Cases of COVID-19 Patients in Croatia by Selected Dates 2020 and 2021*



All search activities using Google for significant terms ''PCR +COVID", "PCR + test", "coronavirus + test" correlate strongly with observed official cases[20] of the disease (Figure 7).

[20]See HZJZ.hr.

In the continuation of the work we tested the model for the most common symptoms of cough, pneumonia, and muscle pain and compared the data with official data[21].

Figure 8. *Correlation between Google Search Index for Query "Cough +Coronavirus" and the Official Number of Reported New Cases of COVID-19 Patients in Croatia by Selected Dates 2020 and 2021*

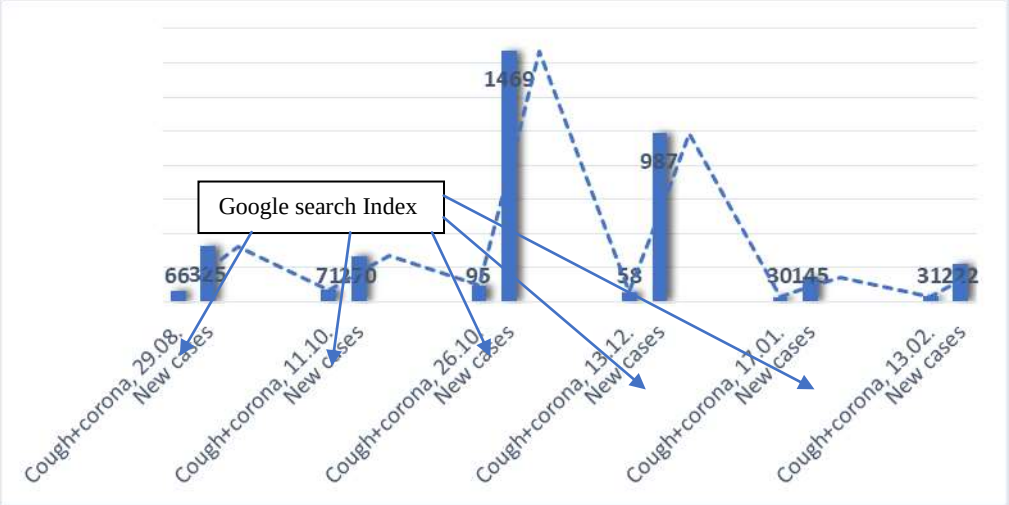
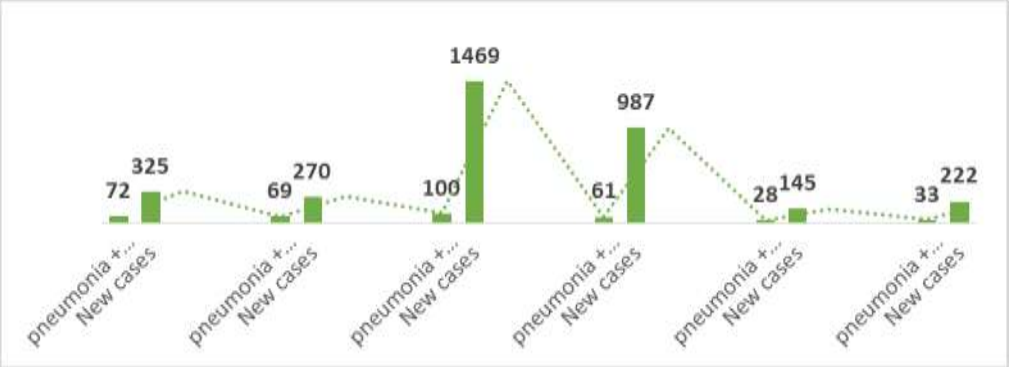
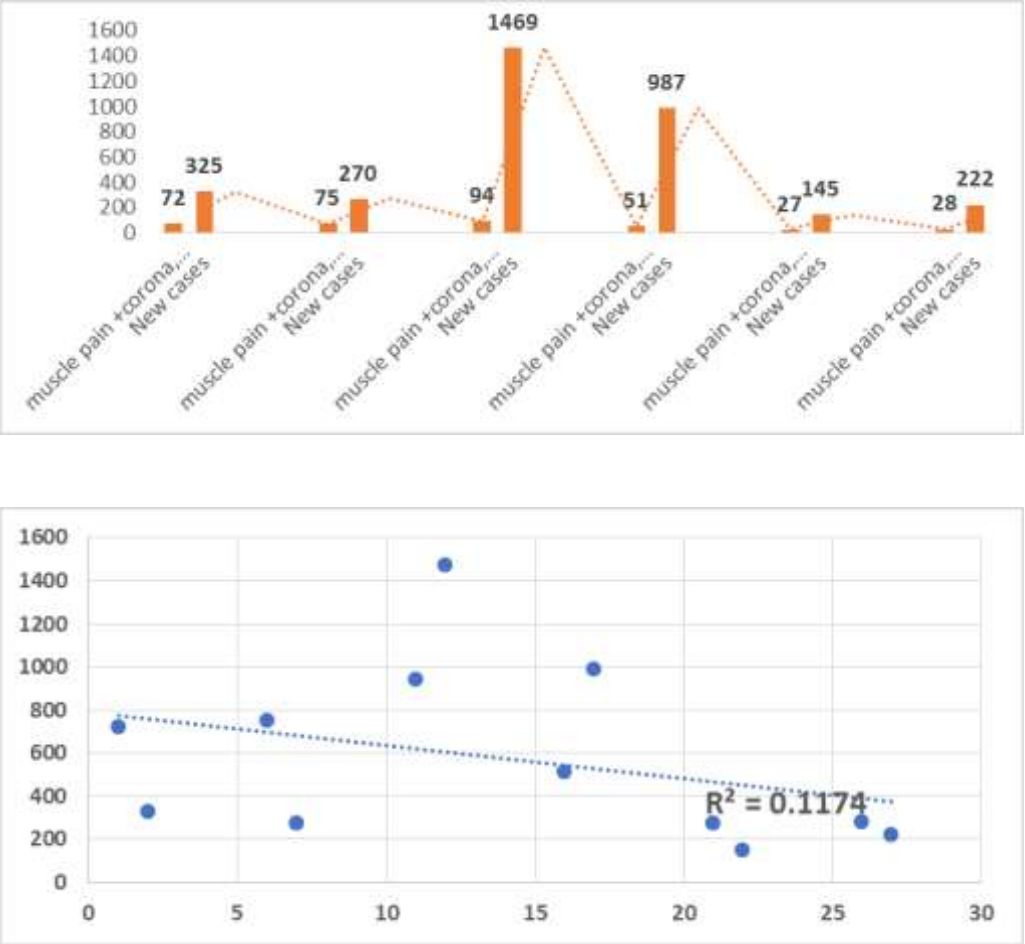


Figure 9. *Correlation between Google Search Index for Query "Pneumonia +Corona" and the Official Number of Reported New Cases of COVID-19 Patients in Croatia by Selected Dates 2020 and 2021*



[21]See HZJZ.hr.

Figure 10. *Correlation between Google Search Index for Query "Muscle Pain +Corona" and the Official Number of Reported New Cases of COVID-19 Patients in Croatia by Selected Dates 2020 and 2021*



The search activities using Google for symptoms "cough + corona", "pneumonia + corona"; "muscle pain + corona" correlate with official data of new cases.

All graphs in Figures 8, 9 and 10 show that the increase in Google search is correlated with the increase in the number of new cases recorded by official statistics and that the decrease in Google search is correlated with the decrease in the number of new cases recorded by official statistics.

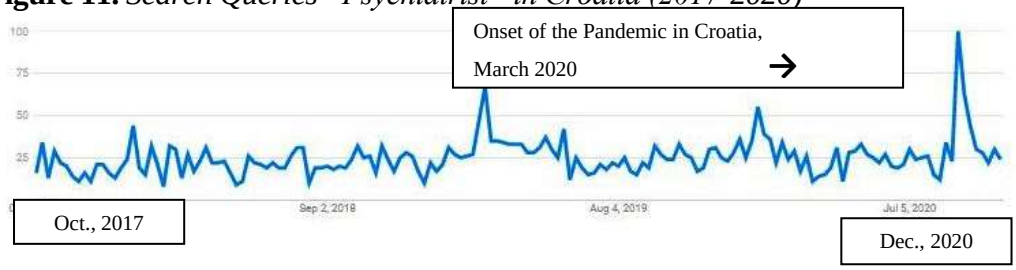
Screening for Mental Health Problems during the Pandemic with Google Trends

The method presented here can also identify clues that could affect mental health in some specific period.

After disasters, most people are resilient and do not succumb to psychopathology. Nevertheless, the primary concern is post-traumatic stress disorder (PTSD) arising from exposure to trauma (see Friedman 2013). Medical conditions from natural causes, such as life-threatening viral infection and earthquakes, do not meet the current criteria for trauma required for a diagnosis of PTSD, but other

psychopathology, such as depressive and anxiety disorders, may ensue (Pfefferbaum and North 2020). It is therefore not surprising that in Croatia search queries "psychiatrist" has increased (Figure 11).

Figure 11. *Search Queries "Psychiatrist" in Croatia (2017-2020)*



We also noticed an increase in searches for tranquilizers and sedatives like *Normabel* (the most popular in Croatia) (Figure 12).

Figure 12. *Search Queries "Sedatives + Normabel" in Croatia (2019-2020)*

Among the global population depression and anxiety disorders have worsened during the COVID-19 pandemic. Current methods for screening these two issues rely on in-person interviews, which can be expensive, time-consuming, and blocked by social stigma and quarantines (Zhang et al. 2020, p. 1). About two-thirds of the sample in a study by Jovic et al. (2020) in the USA reported using the Internet more during the pandemic, and more than 10% of participants spent over 8 h on the Internet daily (Jovic et al. 2020). In the case of Croatia, this depends on socio-economic factors (see introduction). Considering that traditional survey methods are time-consuming and expensive, we need timely and proactive data sources to respond to the rapidly evolving effects of health policy on the population's mental health.

Zhang et al. (2020) show that behaviours on online platforms in the USA can be used to understand personal well-being. Our insights suggest that GT has also the potential to capture clinically alarming deteriorations in the depression and anxiety profiles of users in Croatia in a non-invasive manner. Most importantly, such ubiquitous online footprints may provide useful signals of deteriorating mental health profiles (e.g., depression and anxiety) of users during COVID-19. They may capture insights into what was going on in the mind of the user through

a non-invasive manner (Zhang et al. 2020, p. 1; see Saeb et al. 2016, Ghandeharioun et al. 2017, Wang et al. 2018).

When we look at the results of the most common entries in Croatia before and after Lockdown (Table 2), we can see that common daily topics like matches and the like have completely shifted in the direction of health concerns and other concerns.

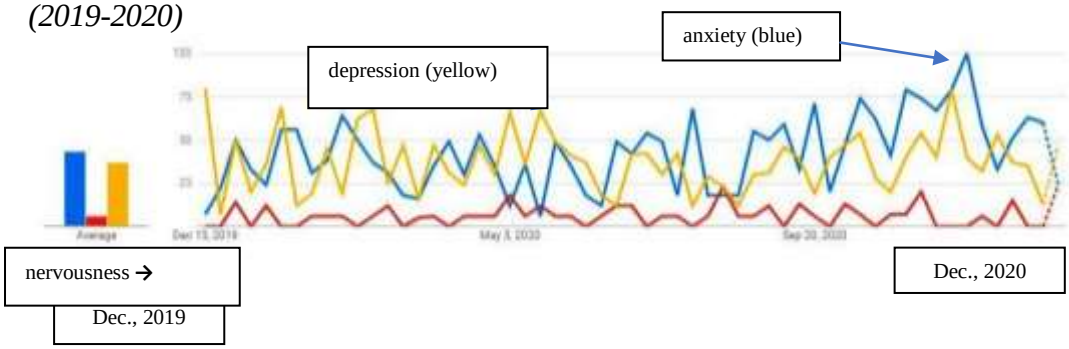
Table 2. *The Top Five Entries in Croatia before and after the Lockdown (2019 and 2020)*

Before lockdown (2019)	**After lockdown (2020)**
1. Results of the EU elections #croatia	1. Coronavirus
2. Strike	2. Google Classroom; Zoom
3 Dinamo - Benfica	3. Office 365 for schools
4 Handball Championship 2019	4. Zagreb earthquake
5 Croatia - Slovakia	5. Kobe Bryant
6 Notre Dame	6. e - Pass
7. Prado Museum	7. US elections
8 Dinamo - Viktoria Plzen (match)	8. Croatia State Election Commission
9 Love is in the Village (series)	9. Joe Biden
10 Wimbledon	10. Masons

Source: Google Year in Search 2020: https://trends.google.com/trends/yis/2020/HR/.

With the use of analytic tools Google Trends, we have developed functions to quantify changes in online behaviour and online searched terms during the pandemic.

Figure 13. *Search Queries "Anxiety + Depression + Nervousness" in Croatia (2019-2020)*



We found that collocations containing the terms "anxiety" and "sadness" keywords under the "negative emotion" dimension showed a significant increase. In this part of the study, it was particularly surprising to us how much the entries related to the phrases "suicide" and "depression" have increased in Croatia (Figure 13).

The results from Zhang et al. (2020) suggested that deteriorating depression and anxiety conditions in the USA have strong correlations with behavioral changes in Google Search use during the COVID-19 pandemic. Though further studies are required, our results for Croatia demonstrate the feasibility of using big data to establish non-invasive surveillance systems for mental health conditions that bypass many disadvantages of existing screening methods.

Domestic Violence and COVID-19 Pandemic

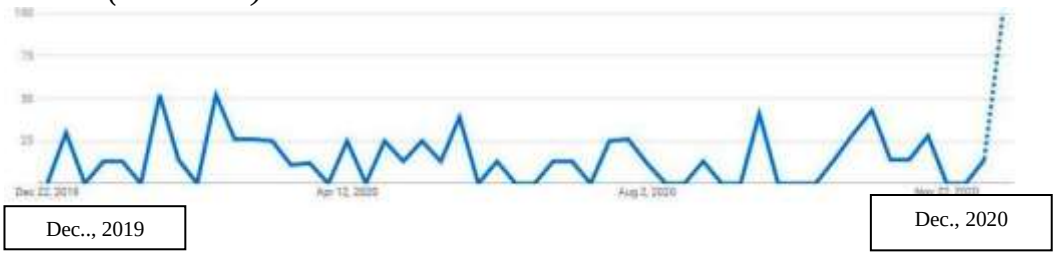
Experts across the globe (USA, Italy, Germany, etc.) acknowledge the risk of an increase in family violence through and possibly beyond the COVID-19 pandemic (UN Women 2020). Preliminary estimates were that "for every 3 months the lockdown continues, an additional 15 million (…) cases of gender-based violence are expected" (UN Population Fund 2020, p. 2).

Economic insecurity and poverty-related stress appear to be the most common pathway linking pandemics and family violence. Economic stress may lead to psychological stress, poor mental health, and maladaptive coping strategies, including substance misuse and stealing money or food, which in turn are linked with an increased risk of family violence (Spiranovic et al. 2020). Social restrictions and lockdowns during the pandemic can have a detrimental impact on parents who might experience additional pressures in cases of school closures. Like the economic stress pathway, psychological stress is linked with increased family violence (Spiranovic et al. 2020). The increased violence has also grown through reductions in outside assistance and options to safely leave a violent relationship (Spiranovic et al. 2020). Restrictions and lockdowns may force women and children to remain within a violent home, and women may also be less willing or able to seek help during pandemics.

Much of this applies also to Croatia. During the first half of 2020, 37% more misdemeanours and as much as 57% more criminal offenses were recorded in Croatia than in the same period in 2019. The Ombudsman Office of the Gender Equality states that during the isolation due to the pandemic, it recorded an increased number of complaints of domestic and partner violence. Therefore, the Office asked the Government for additional protection of women because, statistically speaking, women were a more vulnerable group in terms of labour rights, salaries and pensions, and exposure to domestic and sexual violence during the epidemic[22].

In this period, we see an increase in problems in Croatia related to alcoholism, since there is an evident search for the terms such as "alcoholism", "violence and alcoholism", "how to treat alcoholism" and the like (Figure 14).

Figure 14. *Search Term Related to the Phrase and Collocations "Alcoholism" in Croatia (2019-2020)*



[22]Gender Equality Ombudsman Croatia 2020.

An interesting finding that we have noticed is a serious indication that the number of divorces in Croatia will in 2021 growing. Besides, in 2020, the fewest marriages were concluded in Croatia since the records were kept (DZS 2021).

Influences of COVID-19 Pandemic on Fertility Rate in Croatia – An Approach of Digital Demographic

Historically, as mentioned, economic crises have never been the preferred period for a couple to decide to have a baby. The results of Luppi et al. (2020) show that fertility plans have been negatively revised in all countries, but not in the same way. In Germany and France, fertility plans changed moderately, with many people still planning or postponing their decision to have a child during 2020. In Italy, instead, the proportion of abandoners is much higher than in other countries, while comparatively, it shows a lower proportion of those deciding to postpone their plans (Luppi et al. 2020). Results suggest that different mechanisms are at work, due to the different economic, demographic, and policy pre-crisis backgrounds and post-crisis prospects. Low-fertility contexts, in particular, appear to be more at risk of a fertility loss due to the crisis (Luppi et al. 2020).

In Europe, the climate of uncertainty caused by the COVID-19 pandemic might have been stressed by the still ongoing effect of the 2008 financial crisis, especially in Southern European countries where young people and women's employment indicators and fertility rates are the lowest (Matysiak et al. 2020). Additionally, the physical distancing required by the COVID-19 containment strategy imposed also restrictions to (physical) intergenerational support and this might affect more strongly fertility plans in those countries, such as Italy and Spain, where grandparental childcare is more intensive, also due to lower availability of childcare services (Luppi et al. 2020). In countries where the previous economic and labour market situation was more positive (i.e., Germany and France) the proportion of those abandoning the fertility plans for 2020 is much lower than in the other countries; these countries, instead, show the highest proportion of people still planning a child for 2020. On the contrary, in Southern European countries, and more dramatically in Italy, people are more often abandoning – and not simply postponing – their pre-crisis fertility plans (Luppi et al. 2020).

In general, epidemics and disasters like earthquakes in Croatia (March and December 2020) manifest a common pattern as far as their impact on the population, i.e., a steep decline in birth rates followed by gradual increases and then followed by a baby boom (see Ullah et al. 2020). The USA experienced a decline in birth rates during the great economic recession in 2008, and the trend was sustained till the first half of 2009, whereas the birth rates in 2007 were the highest recorded for the prior two decades (Ullah et al. 2020). A study carried out by Pew Research Center (2009) in the USA reported that 14% (aged 18-34) and 8% (aged 35-44) of those surveyed were still planning to postpone having a child due to the prior financial downturn (Ullah et al. 2020). Other factors such as the availability of contraception and women's educational attainment levels may also influence fertility rates (Ullah et al. 2020). Therefore, the economic recession

caused by the COVID-19 pandemic may impose a long-term impact on the fertility rate, even after the pandemic has abated or been resolved (Ullah et al. 2020).

In this section, we examine the potential effect of the COVID-19 pandemic on future birth rates in Croatia. Keyword and topic selection criteria include search queries in Croatia during 2020: Pregnancy Intention: Ovulation Test, Pregnancy Test; Unplanned Pregnancy: Emergency Contraception, the "Morning-after" pill; Pregnancy Symptoms: Missed Period, Pregnancy Symptoms; Pregnancy Termination, Medical Abortion (see Jurić 2021a). The analytical tool Google Trends is also a useful source of data for determining, estimating, and predicting the fertility rate by the Croatian population. This method shows that monthly births in Croatia will drop sharply by approximately 13% in the year 2021 (Jurić 2021a). These assumptions are already confirmed by the CBS (DZS) for January 2021, where according to official data, a 10% drop in newborns can be seen (DZS 2021).

An important effect on the birth rate is played by the increase in abortions (there are no official data for now). With the GT tool, we noticed in Croatia that the demand for abortion pills increased especially at the time of the pandemic in Croatia. This trend decreased significantly as the number of COVID-19 patients fell in the summer of 2020. We also noticed an increase in searches for the term "abortus" in this period (Jurić 2021a).

In March 2020, there was a fall in demand for pregnancy and ovulation test kits in the USA (Dickson 2020), suggesting fewer people are trying to get pregnant. We also noticed this trend in Croatia based on our method.

Despite the survey in the USA, their sex lives, as well as planning for parenthood, have been substantially influenced during the COVID-19 pandemic (Micelli et al. 2020) by many reasons like worries about future economic difficulties, fear of getting infected, complications during pregnancy, shortage of healthcare workers, and disease clusters in hospitals (Ullah et al. 2020). Studies in the USA have shown that such high fatality disasters lead to a decline in births in the several months that follow such events. After several months (8-12 months) of the epidemics, a reduction in birth rates was apparent and was followed by a noticeable upward trend in the birth rates that lasted well into 20 months after the beginning of each of these epidemics (Ullah et al. 2020).

Figure 15. *Search Terms Related to the Entry "Pregnancy by Weeks" in Croatia (2015-2020)*

Source: Jurić 2021a

Monitoring the search for keywords related to the concepts of pregnancy by week (Figure 15) proved to be a good approach in estimating the decline in birth rates in Croatia, because the first official data for January 2021 confirmed our assumption (DZS 2021, Jurić 2021a).

All these insights show that GT has the potential to capture attitudes in the bride spectrum of family life themes. These insights can be very useful to understand and predict some behaviours in the field of public health and for monitoring families but also for predicting new COVID-19 cases in a specific area.

Conclusion

Our study reduces the gap in human behavioural data, by providing timely and accurate data on individual behaviours, attitudes and monitoring families in Croatia. The paper illustrates how Google Trends together with the official data can offer an innovative and powerful tool for rapid and continuous data collection to monitor trends in behaviours relevant for mitigation strategies of COVID-19.

The basic methodological concept of our approach is to monitor the digital trace of language searches with the Google Trends analytical tool (trends.google.com). We divided the keyword frequency for selected words giving us a search frequency index and then compared searches with official statistics to prove the significations of results. The method tested in this paper confirmed that the increase in Google search is in positive correlation with the increase in the number of new COVID-19 cases and that the decrease in Google search is correlated with the decrease in the number of new cases. Researchers could use this method to provide an earlier and more accurate indication of the re-emergence of the virus in specific parts of the country. If a region experiences an early, sharp increase in COVID-19-like-illness physician visits, it may be possible to focus additional resources on that region to identify the etiology of the outbreak, providing extra vaccine capacity or raising local media awareness as necessary. This is relevant for family life because it has been observed that the virus spreads particularly rapidly in households where more young and old people live together. In countries like Croatia which are characterized by a higher share of intergenerational co-residence and contacts among generations, this fact became a risk factor during epidemics. With the early detection of the spread of the virus in certain parts of the country, measures such as closing cafes, clubs, and switching to online classes, etc. can be introduced quickly to take preventive action.

The presented method contributes also in a way that proves the feasibility of measuring certain attitudes and behaviours in family life's during pandemics such as an increase in stress, anxiety, and domestic violence and can give reliable projection-related estimates regarding birth rates in the future. During the isolation due to the pandemic, in Croatia, we recorded an increased number of indices of domestic and partner violence. With Google Trends, we found that collocations containing the terms "anxiety" and "sadness" keywords under the "negative emotion" dimension showed a significant positive correlation. We see also an increase in problems in Croatia related to alcoholism.

Historically, crises have never been the preferred period for a couple to decide to have a baby. An important effect on the birth rate is played by the increase in abortions. With the GT tool, we noticed in Croatia that the search for keywords related to the concepts of pregnancy by week proved to be a good approach in estimating the decline in birth rates in Croatia, because the first official data for January 2021 confirmed our assumption.

According to our method, in Croatia, the birth rate in 2021 will be just 87% of what it would be "a normal year". Monitoring the search for keywords related to the concepts of pregnancy by week proved to be a good approach in estimating the decline in birth rates in Croatia, because the first official data for January 2021 confirmed our assumption (DZS 2021).

Unquestionably, there are significant open methodological issues and the questionable integrity of the data obtained using this source. The fact is also a problem that GT does not provide data on which population was sampled or how it was structured. Although these open-ended issues pose serious challenges for making clear estimates, statistics offer a range of tools available to deal with imperfect data as well as to develop controls that take data quality into account. Many of these limitations can be overcome also by triangulation.

All these insights show that GT has the potential to capture attitudes in the bride spectrum of family life themes. These insights can be very useful to understand and predict some behaviours in the field of public health and for monitoring families but also for predicting new COVID-19 cases in a specific area, which makes it possible to take preventive actions promptly.

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