Review

Cancer Drugs and Target Prediction in Human. Minireview

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Review

Cancer Drugs and Target Prediction in Human. Minireview

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* Correspondence: ORCID: 0000-0002-1405-1728; Laboratorio de Farmacología, Instituto Nacional de Pediatría. Av. Iman No.1, 3er piso, Col. Cuicuilco, Mexico City, CP 04530; juarezol@yahoo.com; Tel. & fax 5255 1084 3883, Running Title: Cancer and drug target prediction on human

Abstract: The present minireview assessed the benefits of using artificial intelligence applications in healthcare at predicting the targets of bioactive small molecules in human. Method. The tool is a tuned algorithm, with novel data in web interface. Results. We used tables to order the information of Swiss Target Prediction that allow predictions on combination of chemotherapies and probable side effects. This tool is useful to understand the molecular mechanisms underlying a given phenotype or bioactivity, to rationalize possible favorable or unfavorable side effects and to predict off-targets of known molecules as well as to clear the way for drug repurposing. Predictions are done using a ligand-based approach to compare the similarity between a query molecule and the known ligands of a large collection of protein targets. Conclusion. This study allowed us to formulate recommendations for the use of some of the chemotherapeutic agent groups in cancer patients at a low cost. It is very important and beneficial for patients that take medicine for a longer period and on whose lives depend on such treatment.

Keywords: artificial intelligence; cancer; Covid.19; chemotherapy; target prediction drugs

Introduction

Cancer is defined as a proliferation disorder of cells that acquired the capacity of invading other tissues and sending metastasis to distant areas of the body, which together, bring about eventual death of the host [1]. This disease has come to constitute a major problem of public health. Despite the benefits of advances in research and treatment, more than six million people in the world die of the disease. It is estimated that if early prevention strategies are not implemented, there will be millions of new cases in the future, which will ultimately collapse the resources and infrastructures of health services of the countries, due to the high cost of cancer therapies. Cancer patients need an integral treatment and in most of the cases patients, families and even institutions of sanitary attention are unable to afford the high cost [2]. Hence, it is extremely important to develop preventive and low-cost management strategies to handle the problem. Table 1 and table 2 below, respectively show the common types of cancer and cancer diagnosis based on gender:

Table 1. Common cancer types.

Liver cancer	**Colon** cancer
Breast cancer	**Prostate** cancer
Skin cancer	**Lymphoma** cancer
Uterine cancer	**Stomach** cancer
Lung cancer	**Pancreatic** cancer

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Table 2. Types of cancer diagnosis based on gender in hospitalized patients .

	Young men		Young women	
	Diagnosis	Cases	Diagnosis	Cases
1	Severe aplastic anemia	1	Metastatic Choriocarcinoma	1
2	Cervical lymphadenopathy	1	Ovarian Choriocarcinoma	1
3	Colon adenocarcinoma	1	Estesioneuroblastoma	1
4	Congenital cardiopathy	2	Ganglioneuroblastoma	1
5	Craneopharyngioma	1	Hepatosplenomegaly	1
6	suprarenal ganglioneuroblastoma	1	Hepatoblastoma	2
7	Germinoma	2	Hemangioma of tongue	1
8	eosinophilic granuloma	1	Hepatoblastoma	1
9	Glioblastoma	1	Histiocytosis	1
10	Hepatoblastoma	3	Acute Lynphoblastic Leukemia	30
11	Histiocytosis	3	Acute Granulocytic Leukemia	1
12	Langerhan's cell Histiocytosis	3	Lymphoblastic Lymphoma	1
13	Leukemia acute	2	Lymphangiomalipoblastoma	1
14	Acute Lymphoblastic Leukemia	30	Burkitt's Lymphoma	3
15	Acute megakaryocytic Leukemia	1	Hodgkin's Lymphoma	5
16	Submaxillary Lymphadenopathy	1	Diffuse Colon Lymphoma	1
17	Burkitt`s Lymphoma	2	Lymphoblastic Lymphoma of bone	1
18	Hodgkin's Lymphoma	9	Medulloblastoma	2
19	Diffuse large B cell Lymphoma	1	Neuroblastoma	4
20	Lymphoma	1	Right Retro-orbital Neuroblastoma	1
21	Lymphoblastic Lymphoma	1	Right femur Osteosarcoma	1
22	Arteriovenous malformation	2	lymphadenopathy Osteosarcoma	1
23	Medulloblastoma	4	Maxillary Osteosarcoma	1
24	Classic Medulloblastoma	1	Osteoblastic Osteosarcoma	5
25	Neuroblastoma	6	Osteosarcoma of the knee	1
26	Osteoblastic Osteoblastoma	1	Osteosarcoma	5
27	Androblastic Osteosarcoma	1	Aneurysmal cyst bone	1
28	Anaplastic Osteosarcoma	1	Rhabdomyosarcoma	5
29	Osteoblastic Osteosarcoma	5	Alveolar Rhabdomyosarcoma	1
30	Osteosarcoma	6	Embryonal Rhabdomyosarcoma	2
31	Astrocytoma	1	Retinoblastoma	8
32	Pancreatoblastoma	1	Ewing's Sarcoma	12
33	Pan hypopituitarism	1	Pseudocyst cerebral	1
34	Pineoloblastoma	1	Immature Teratoma	1
35	Polyploidy	1	Cystic Teratoma	1
36	Cyst of iliac bone	1	Tumor astropolitik	1
37	Rhabdomyosarcoma	4	Central Parietal Right Tumor	1
38	Alveolar Rhabdomyosarcoma	2	Endodermic Sinus Tumor	1
39	Bilateral Retinoblastoma	3	Neuroblastic Tumor of ganglion	1
40	Retinoblastoma	7	Germinal Ovary Tumor	1

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41	Orbit Retinoblastoma	1	Mixed Germinal Tumor	3
42	Ewing's Sarcoma	2	Frontoparietal Tumor	1
43	Axial Ewing's Sarcoma	1	Neuroectodermic Tumor	1
44	Synovial Sarcoma	1	Tumor of ovary	1
45	Granulocytic Sarcoma	1	Mixed ovarian germinal tumor	1
46	Myeloid Sarcoma	1	Polycystic tumor	2
47	Hemophagocytic Syndrome	1	Wilms Tumor	8
48	Schualuma malignant	1	Submandibular Tumor	1
49	Endodermic Sinus Tumor	1	Total	131
50	Testicular Endodermic Sinus Tumor	1		
51	Mediastinal Tumor	1		
52	Wilms Tumor	4		
53	Fibrous Tumor	2		
54	Germinal Tumor	1		
55	Neuroectodermal Mesenteric Tumor	1		
56	Bone Tumor	1		
57	Left Testicular Tumor	1		
58	Right Testicular Tumor	1		
59	Neuroectodermal Tumor	1		
60	Retro-orbital Tumor	1		
	Total	142		

Today, many different kinds of chemotherapy or chemo-drugs are used to treat cancer. These substances are applied either alone or in combination with other drugs or treatments. These drugs are very different in their chemical composition, as well as in the way they are prescribed and given. Moreover, their usefulness in treating certain types of cancer and their side effects vary [3].

Anticancer drug development over the past 50 years, can be grouped based on their pharmacodynamic characteristics, their chemical structure and their relationships to other drugs (table 3).

Table 3. Drugs used cancer management.

Doxorubicin	Capecitabine	Methotrexate	5-fluorouracil
Epirubicin	Eribulin	Pralatrexate	6-Mercaptopurine
Cyclophosphamide	Entansime	Valrubicin	Azacitidine
Paclitaxel	Abraxane	Omacetaxine	Bleomycin
Cisplatin	Ixabepilone	Mitoxantrone	Cladribine
Altretamine	Mechlorethamine	Nelarabine	Dactinomycin
Clofarabine	Dacarbazine	Trabectedin	Daunorubicin
Docetaxel	Abemaciclib	Mitotane	Etoposide
Carboplatin	Asparaginase	Vincristine	Floxuridine
Gemcitabine	Arsenic trioxide	Liposomal doxorubicin	Fludarabine
Cytarabine	Ifosfamide	Streptozocin	Idarubicin
Carmustine	Temozolomide	Thioguanine	Irinotecan
Bendamustine	Melphalan	Pemetrexed	Mitomycin-C
Busulfan	Oxaliplatin	Pentostatin	Topotecan
Cabazitaxel	Ixabepilone	Romidepsin	Pegaspargase
Teniposide	Vinorelbine	Omacetaxine	Procarbazine

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Vinblastine	Mitotane	Vorinostat	Tirinacil
Chlorambucil	Thiotepa	Trifluridine	Hydroxyurea
Decitabine	Lomustine	Nab-paclitaxel	Prednisone

Relevant sections

The risk of COVID-19 infection for cancer patients is reported slightly high compared with the general population. Among patients with cancer and COVID-19, severe illness and mortality is slightly high and this is associated to the combine effect of general risk factors and peculiar risk factors of cancer patients [4]. The basic nutritional management for cancer patients is administration of adequate amount of energy, protein/amino acids and micronutrients in order to prevent malnutrition coupled with suitable rehabilitation [5].

It is important to note that not all medicines and drugs used in cancer treatment work the same way. Other drugs, such as targeted therapy, hormone therapy and immunotherapy applied in cancer management, work differently. Cancer patients are highly vulnerable to SARS-CoV-2 infections due to their frequent contacts with the healthcare system, their immunocompromised state caused by cancer or its therapies, supportive medications such as steroids, and most importantly, their advanced age and comorbidities [6]. Chemotherapy drugs target cells at different phases of the cell cycle. Understanding how these drugs work could help the doctors predict which drug combinations are likely to give better results. Moreover, doctors can plan the administration frequency of each drug based on cell phase timing [7]. Cancer therapy should not be suspended or postponed under SARS-CoV-2 infections, since this will worsen the condition of the patients and may lead to immediate death in aggressive cases.

In fact, cancer cells tend to form new cells more quickly than normal cells and this makes them a better target for chemotherapy drugs. However, chemo drugs are not selective in cell destruction as they can attack both healthy and cancerous cells. This means that these drugs damage normal cells along with the cancer cells, with untold side effects.

Discussion and conclusions

The side effects of chemotherapy in cancer patients are important and determine the tolerability and continuation of therapy, and adversely affect the patients' life quality [8]. Every administration of chemo should aim at finding a balance between killing the cancer cells and sparing the normal cells. However, the good news is that most normal cells are capable of recovering from the effects of chemo over time, a situation, which does not prevail in cancer cells, since they are mutated cells. These kind of cells are incapable to recover from the effects of chemo; hence, constituting advantage in the use of chemo to attack many types of cancer cells [9].

Advances in cancer chemotherapy has been greatly supported mainly by the progresses in studies of tumor cell biology and in the development of new anticancer drugs, studies that are fundamental in discerning drug resistance, ensure adequate biochemical modulation and prediction target tool.

The follow information describes chemotherapy target prediction, for developing new strategies with personalized cancer treatments (Table 4).

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Table 4. Target prediction in human

Drugs for cancer	Target prediction in human					
1. Fludarabine	Writer 20%	Family A G protein-coupled receptor 20%	Enzyme 13.3%	Other cytosolic protein 13.3%	Oxidoreductase 6.7%	Kinase 6.7%
	Protease 6.7%	Unclassified protein 6.7%	Hydrolase 6.7%			
2. Floxuridine	Enzyme 53.3%	Transferase 13.3%	Lyase 13.3%	Family A G protein-coupled receptor 6.7%	Hydrolase 6.7%	Eraser 6.7%
3. Cytarabine	Enzyme 20%	Family A G protein-coupled receptor 20%	Transferase 13.3%	Unclassified protein 13.3%	Hydrolase 6.7%	Other cytosolic protein 6.7%
	Protease 6.7%	Oxidoreductase 6.7%	Kinase 6.7%			
4. Altretamine	Family A G protein-coupled receptor 66.7%	Other cytosolic protein 13.3%	Cytochrome P450 6.7%	Ligand-gated ion channel 6.7%	Enzyme 6.7%	
5. Bendamustine	Eraser 40%	Phosphodiesterase 26.7%	Family A G protein-coupled receptor 13.3%	Oxidoreductase 6.7%	Electrochemical transporter 6.7%	Nuclear receptor 6.7%
6. Busulfan	Protease 40%	Ligand-gated ion channel 20%	Family A G protein-coupled receptor 6.7%	Unclassified protein 6.7%	Electrochemical transporter 6.7%	Adhesion 6.7%
	Hydrolase 6.7%	Enzyme 6.7%				
7. Carmustine	Enzyme 46.7%	Hydrolase 13.3%	Oxidoreductase 6.7%	Other cytosolic protein 6.7%	Family C G protein-coupled 6.7%	Protease 6.7%
	Aminoacyltransferase 6.7%	Phosphodiesterase 6.7%				
8. Chlorambucil	Family A G protein-coupled receptor	Electrochemical transporter 20%	Oxidoreductase 13.3%	Enzyme 13.3%	Nuclear receptor 6.7%	Secreted protein 6.7%

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	20%					
	Protease 6.7%	Unclassified protein 6.7%	Fatty acid binding protein family 6.7%			
9. Dacarbazine	Family A G protein-coupled receptor 26.7%	Kinase 20%	Lyase 20%	Protease 6.7%	Oxidoreductase 6.7%	Writer 6.7%
	Phosphodiesterase 6.7%	Transcription factor 6.7%				
10. Ifosfamide	Protease 40%	Enzyme 13.3%	Electrochemical transporter 13.3%	Cytochrome P450 13.3%	Family C G protein-coupled receptor 6.7%	Family A G protein-coupled receptor 6.7%
	Unclassified protein 6.7%					
11. Lomustine	Enzyme 20%	Family A G protein-coupled receptor 13.3%	Oxidoreductase 13.3%	Electrochemical transporter 13.3%	Lyase 13.3%	Cytochrome P450 13.3%
	Reader 6.7%	Family C G protein-coupled receptor 6.7%				
12. Mechlorethamine	Family A G protein-coupled receptor 20%	Lyase 20%	Kinase 13.3%	Oxidoreductase 13.3%	Protease 6.7%	Hydrolase 6.7%
	Enzyme 6.7%	Other cytosolic protein 6.7%	Ligand-gated ion channel 6.7%			
13. Melphalan	Lyase 26.7%	Enzyme 20%	Hydrolase 13.3%	Electrochemical transporter 6.7%	Calcium channel auxiliary subunit alpha2delta family 6.7%	Other cytosolic protein 6.7%
	Kinase 6.7%	Membrane receptor 6.7%	Protease 6.7%			
14. Temozolomide	Eraser 26.7%	Lyase 26.7%	Kinase 20%	Enzyme 6.7%	Family A G protein-coupled receptor	Phosphodiesterase 6.7%

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					6.7%	
	Protease 6.7%					
15. Thiotepa	Oxidoreductase 28.6%	Family A G protein-coupled receptor 21.4%	Transcription factor 14.3%	Eraser 14.3%	Ligand-gated ion channel 7.1%	Hydrolase 7.1%
	Transferase 7.1%					
16. Trabectedin	Lyase 33.3%	Kinase 20%	Protease 20%	Enzyme 20%	Other ion channel 6.7%	
17. Streptozocin	Enzyme 33.3%	Family A G protein-coupled receptor 20%	Protease 13.3%	Lyase 13.3%	Hydrolase 6.7%	Transferase 6.7%1
	Other cytosolic protein 6.7%					
18. Hydroxyurea	Lyase 100%					
19. Nelarabine	Lyase 26.7%	Family A G protein-coupled receptor 20%	Enzyme 13.3%	Other cytosolic protein 13.3%	Unclassified protein 6.7%	Hydrolase 6.7%
	Protease 6.7%	Electrochemical transporter 6.7%				
20. Pemetrexed	Enzyme 26.7%	Electrochemical transporter 13.3%	Membrane receptor 13.3%	Lyase 13.3%	Transferase 6.7%	Oxidoreductase 6.7%
	Ligase 6.7%	Hydrolase 6.7%	Unclassified protein 6.7%			
21. Thioguanine	Lyase 33.3%	Kinase 26.7%	Oxidoreductase 6.7%	Enzyme 6.7%	Hydrolase 6.7%	Voltage-gated ion cannel 6.7%
	Family A G protein-coupled receptor 6.7%	Electrochemical transporter 6.7%				
22. Trifluridine	Enzyme 53.3%	Transferase 20%	Family A G protein-coupled receptor 13.3%	Hydrolase 6.7%	Electrochemical transporter 6.7%	

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23. Daunorubicin	Family A G protein-coupled receptor 26.7%	Kinase 20%	Eraser 20%	Protease 6.7%	Isomerase 6.7%	Other cytosolic protein 6.7%
	Unclassified protein 6.7%	Enzyme 6.7%				
24. Idarubicin	Kinase 20%	Enzyme 20%	Family A G protein-coupled receptor 13.3%	Protease 6.7%	Isomerase 6.7%	Other cytosolic protein 6.7%
	Transcription factor 6.7%	Voltage-gated ion cannel 6.7%	Eraser 6.7%	Transferase 6.7%		
25. Valrubicin	Kinase 26.7%	Eraser 20%	Family A G protein-coupled receptor 13.3%	Protease 13.3%	Isomerase 6.7%	Unclassified protein 6.7%
	Other cytosolic protein 6.7%	Transcription factor 6.7%				
26. Mitomycin C	Eraser 26.7%	Lyase 26.7%	Enzyme 13.3%	Kinase 13.3%	Family A G protein-coupled receptor 13.3%	Cytochrome P450 6.7%
27. Irinotecan	Family A G protein-coupled receptor 20%	Electrochemical transporter 20%	Eraser 20%	Hydrolase 6.7%	Protease 6.7%	Isomerase 6.7%
	Other nuclear protein 6.7%	Cytochrome P450 6.7%	Transcription factor 6.7%			
28. Topotecan	Electrochemical transporter 20%	Family A G protein-coupled receptor 20%	Eraser 20%	Isomerase 6.7%	Cytochrom e P450 6.7%	Transcription factor 6.7%
	Other nuclear protein 6.7%	Protease 6.7%	Hydrolase 6.7%			
29. Teniposide	Protease 33.3%	Cytochrome P450 20%	Family A G protein-coupled receptor 13.3%	Oxidoreduc tase 13.3%	Nuclear receptor 6.7%	Electrochemical transporter 6.7%
	Enzyme 6.7%					

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30. Cabazitaxel	Family A G protein-coupled receptor 40%	Kinase 13.3%	Family B G protein-coupled receptor 6.7%	Cytochrome P450 6.7%	Structural protein 6.7%	Primary active transporter 6.7%
	Protease 6.7%	Other cytosolic protein 6.7%	Phosphodiesterase 6.7%			
31. Vinblastine	Kinase 40%	Protease 20%	Family A G protein-coupled receptor 13.3%	Cytochrome P450 13.3%	Primary active transporter 6.7%	Other cytosolic protein 6.7%
32. Vinorelbine	Protease 26.7%	Cytochrome P450 13.3%	Kinase 13.3%	Family A G protein-coupled receptor 13.3%	Other ion channel 13.3%	Primary active transporter 6.7%
	Phosphodiesterase 6.7%	Enzyme 6.7%				
33. Ixabepilone	Kinase 33.3%	Enzyme 26.7%	Other cytosolic protein 20%	Oxidoreductase 6.7%	Ligand-gated ion channel 6.7%	Nuclear receptor 6.7%
34. Mitotane	Family A G protein-coupled receptor 26.7%	Electrochemical transporter 20%	Enzyme 13.3%	Voltage-gated ion channel 6.7%	Nuclear receptor 6.7%	Kinase 6.7%
	Transcription factor 6.7%	Unclassified protein 6.7%	Ligand-gated ion channel 6.7%			
35. Omacetaxine	Kinase 73.3%	Protease 13.3%	Enzyme 6.7%	Family A G protein-coupled receptor 6.7%		
36. Romidepsin	Eraser 66.7%	Family A G protein-coupled receptor 13.3%	Phosphodiesterase 6.7%	Enzyme 6.7%	Protease 6.7%	
37. Vorinostat	Eraser 86.7%	Protease 6.7%	Ligand-gated ion channel 6.7%			
38. Procarbazine	Kinase 73.3%	Family A G protein-coupled receptor 13.3%	Cytochrome P450 6.7%	Nuclear receptor 6.7%		

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39. Nab-paclitaxel	Family A G protein-coupled receptor 26.7%	Kinase 26.7%	Protease 13.3%	Structural protein 6.7%	Primary active transporter 6.7%	Family B G protein-coupled receptor 6.7%
	Cytochrome P450 6.7%	Phosphodiesterase 6.7%				
40. Docetaxel	Kinase 33.3%	Family A G protein-coupled receptor 26.7%	Family B G protein-coupled receptor 6.7%	Primary active transporter 6.7%	Structural protein 6.7%	Cytochrome P450 6.7%
	Phosphodiesterase 6.7%	Protease 6.7%				
41. Paclitaxel	Family A G protein-coupled receptor 26.7%	Kinase 26.7%	Protease 13.3%	Structural protein 6.7%	Primary active transporter 6.7%	Family B G protein-coupled receptor 6.7%
	Cytochrome P450 6.7%	Phosphodiesterase 6.7%				
42. Cyclophosphamide	Protease 33.3%	Enzyme 20%	Electrochemical transporter 13.3%	Cytochrome P450 13.3%	Family A G protein-coupled receptor 6.7%	Family C G protein-coupled receptor 6.7%
	Unclassified protein 6.7%					
43. Doxorubicin	Kinase 20%	Eraser 20%	Protease 13.3%	Family A G protein-coupled receptor 13.3%	Isomerase 6.7%	Other cytosolic protein 6.7%
	Unclassified protein 6.7%	Enzyme 6.7%	Transcription factor 6.7%			
44. Epirubicin	Kinase 20%	Eraser 20%	Family A G protein-coupled receptor 13.3%	Protease 13.3%	Isomerase 6.7%	Other cytosolic protein 6.7%
	Unclassified protein 6.7%	Enzyme 6.7%	Transcription factor 6.7%			
45. Gemcitabine	Lyase 33.3%	Enzyme 20%	Transferase 13.3%	Family A G protein-coupled receptor	Oxidoreductase 13.3%	Hydrolase 6.7%

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				13.3%		
46. Carboplatin	Enzyme 45.5%	Phosphatase 18.2%	Family A G protein-coupled receptor 18.2%	Transferase 9.1%	Oxidoreductase 9.1%	
47. Abemaciclib	Kinase 26.7%	Protease 26.7%	Other cytosolic protein 13.3%	Enzyme 6.7%	Voltage-gated ion channel 6.7%	Membrane receptor 6.7%
	Phosphodiesterase 6.7%	Family A G protein-coupled receptor 6.7%				
48. Abraxane	Family A G protein-coupled receptor 26.7%	Kinase 26.7%	Protease 13.3%	Structural protein 6.7%	Primary active transporter 6.7%	Family B G protein-coupled receptor 6.7%
	Cytochrome P450 6.7%	Phosphodiesterase 6.7%				
49. Capecitabine	Kinase 33.3%	Unclassified protein 20%	Enzyme 20%	Electrochemical transporter 13.3%	Family A G protein-coupled receptor 13.3%	
50. Eribulin	Protease 33.3%	Family A G protein-coupled receptor 26.7%	Phosphatase 13.3%	Cytochrome P450 6.7%	Enzyme 6.7%	Secreted protein 6.7%
	Phosphodiesterase 6.7%					
51. L-Asparagine	Family C G protein-coupled receptor 33.3%	Ligand-gated ion channel 33.3%	Electrochemical transporter 20%	Family A G protein-coupled receptor 6.7%	Transferase 6.7%	
52. Methotrexate	Lyase 20%	Eraser 20%	Electrochemical transporter 13.3%	Membrane receptor 13.3%	Enzyme 13.3%	Oxidoreductase 6.7%
	Transferase 6.7%	Ligase 6.7%				
53. Pralatrexate	Lyase 26.7%	Electrochemical transporter 13.3%	Membrane receptor 13.3%	Enzyme 13.3%	Oxidoreductase 6.7%	Ligase 6.7%
	Transferase 6.7%	Protease 6.7%	Kinase 6.7%			

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54. Vincristine	Protease 26.7%	Kinase 26.7%	Family A G protein-coupled receptor 20%	Cytochrome P450 13.3%	Primary active transporter 6.7%	Enzyme 6.7%
55. Mitoxantrone	Kinase 33.3%	Family A G protein-coupled receptor 26.7%	Electrochemical transporter 20%	Isomerase 6.7%	Voltage-gated ion channel 6.7%	Enzyme 6.7%
56. Etoposide	Protease 26.7%	Electrochemical transporter 20%	Cytochrome P450 20%	Family A G protein-coupled receptor 13.3%	Nuclear receptor 6.7%	Phosphodiesterase 6.7%
	Oxidoreductase 6.7%					
57. Azacitidine	Enzyme 33.3%	Lyase 26.7%	Other cytosolic protein 13.3%	Hydrolase 6.7%	Family A G protein-coupled receptor 6.7%	Kinase 6.7%
	Eraser 6.7%					
58. 5-Fluorouracil	Enzyme 26.7%	Ligand-gated ion channel 26.7%	Lyase 13.3%	Hydrolase 13.3%	Eraser 6.7%	Family A G protein-coupled receptor 6.7%
	Transferase 6.7%					
59. Mercaptopurine	Lyase 46.7%	Kinase 26.7%	Enzyme 13.3%	Oxidoreductase 6.7%	Protease 6.7%	

Future Directions

We used machine with build models to cancer drug target prediction. Then, new chemo-protective drugs are developed and specialists contribute to the solution of unmet needs to elucidate epidemiologic and pathophysiologic aspects, as potential tools for detection and monitoring of cancer dysfunction. This study allowed us to formulate recommendations for the use of some of the chemotherapeutic agent groups in cancer patients, which made it possible to lower the cost of treatment. It is very important for patients that take medicine for a longer period and on whose lives depend on it.

Author Contributions: DCG[a,b,c,d,e], NOB[b,c,d,e], AVP[b,c,d,e], MOH[b,c,d,e], DEOG[b,c,d,e], HJO[b,c,d,e], GBJ. [a] Contributed to the conception and design of the work. [b] Contributed to the collection, analysis, or interpretation of data. [c] Critically revised the manuscript for important intellectual content. [d] Drafted manuscript. [e] Gave final approval.

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Conflicts of Interest: The authors declare that they have no conflict of interest.

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