# The impact of the COVID-19 pandemic on Hospital Admissions:
# A DRG-based comparative analyses in Croatia, Germany and Australia

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## Ready for the next crisis?

**Investing in Health System Resilience***

- Health systems were underprepared
- Health systems were understaffed
- Health systems suffered from underinvestment.

**Health systems resilience during COVID-19: Lessons for building back better****

"Resilience is the ability of the health system **to prepare for, manage and learn** from a sudden and extreme disturbance.

It is about **maintaining** the performance of core health system functions. "

# Comparative overview of DRG implementation in Croatia, Germany and Australia

| Criteria for success | Australia | Germany | Croatia |
|---|---|---|---|
| 1. Observing goals and building solid foundations for DRGs | Australia has been involved in the development of DRG since the 1970s driven by the realization that being able to measure hospital production would provide considerable benefits to the system by understanding what hospitals do and thus how best to pay for them. | Highlighted objectives: Reform of the payment model for better allocation of funds; increasing the efficiency and quality of services; limiting cost growth. Implementation marked by a strategic step-by-step approach for the development of its own DRG system. | Highlighted goals: reducing costs, rationalizing resource use, improving efficiency and increasing efficiency. Implementation characterized by ad hoc application of the established DRG variant. |
| 2. Good governance of DRG transition | The Australian federal government is responsible for DRG policy and standards. State governments are responsible for implementation systems and DRG-based payments. | Joint implementation of G-DRGs by the Federal Association of Health Funds, the Private Health Insurance Association and the German Hospital Federation, authorized by the Federal Government. | Implemented and managed by the Croatian Health Insurance Fund (CHIF). In 2007, the AR-DRG system was introduced. Payments and monitoring of DRG-based hospital activities began in 2009. |
| 3. Meeting the technical requirements of DRG system implementation | Australia developed the AR-DRG system based on research started in the 1970s, and the first local variant (AN-DRG) was introduced in 1992. The AR-DRG variant was first available in 1998 and since then new versions have been released every two years. The latest version is AR-DRG v11. 0. | The G-DRG system is based on AR-DRG v 4.1. Implementation was carried out over a ten-year period. The DRG classification has been modified to suit local conditions, with groups increasing from 664 groups in 2003 to 1,200 in 2010 and to 1,251 in 2021 with 5 levels of complexity and an additional nursing care system. | The current DRG system  is  a hybrid of AR-DRGs v.5.2 and 6  localy designed  DRG groups (in total 671 groups). Also  in 2024 Croatia procured AR-DRG v.11.0 and  has started its implementation through DG Reform financed project. |
| 4. Building an efficient DRG based payment model | Efficient payment model: DRG-based payments and budget allocations are used in states. The national government is responsible for state funding and in 2014 introduced the concept of national weighted activities units (NWAUs) for use in determining and paying the hospital budget. years. | Effective payment model: DRG-based payments and budget allocations. The transition to payment from DRG occurred between 2005 and 2009. The hospital payment model, in addition to paying DRG, includes allocations for emergency services, day hospitals, innovation technology, quality of care and adjustment for local conditions. | Payment model: changed over time, The DRG component was 10%. Additional payments for expensive drugs, intervention procedures, especially contracted procedures. Frequent changes to the unit price that does not correspond to the average cost of production. |

# Methods

The study relies on publicly available data from institutions/agencies responsible for inpatient DRG data collection and analyses in the involved countries:

The Croatian Health Insurance Fund (CHIF) and Croatian Institute for Public Health (CIPH);

Institute for the Hospital Remuneration System (InEK)

Independent Hospital and Aged Care Pricing Authority (IHACPA), and Australian Institute of Health and Welfare (AIHW).

The research is a retrospective, comparative analyses of the hospital admission rate across all DRGs before (2019) and during pandemic (2020-2022).

## Results

### Comparison of DRG case activity (acute admitted care) before and during COVID-19

| | Croatia | Germany | Australia* | Australia** (Public hospitals) | Australia** (Public and Private hospitals) |
|---|---|---|---|---|---|
| Pre-COVID phase (2019) | 549,957 | 19,027,795 | 6,458,614 | 6,430,118 | 10,495,725 |
| COVID-19 phase (2020-2022) | 464,283 | 16,462,679 | 6,476,197 | 6,434,170 | 10,607,962 |
| Change (%) | -16 | -16 | +0.02 | +0.01 | +1 |

Source: CHIF, InEK, IHACPA*, AIHW**, Authors calculations

## Results – MDC case activity (preCOVID-19 vs 1st year of COVID-19 phase

| Major Diagnostic Category | Australia Change (%) | Germany Change (%) | Croatia Change (%) |
|---|---|---|---|
| MDC 00 - Pre MDC | +4 | -8 | +6 |
| MDC 01 Diseases and Disorders of the Nervous System | +1 | -15 | -22 |
| MDC 02 Diseases and Disorders of the Eye | +1 | -14 | -46 |
| MDC 03 Diseases and Disorders of the Ear, Nose, Mouth and Throat | -7 | -17 | -39 |
| MDC 04 Diseases and Disorders of the Respiratory System | -13 | -22 | -2 |
| MDC 05 Diseases and Disorders of the Circulatory System | -3 | -15 | -22 |
| MDC 06 Diseases and Disorders of the Digestive System | +2 | -14 | -21 |
| MDC 07 Diseases and Disorders of the Hepatobiliary System and Pancreas | +2 | -18 | -23 |
| MDC 08 Diseases and Disorders of the Musculoskeletal System and Connective Tissue | No changes | -6 | -22 |
| MDC 09 Diseases and Disorders of the Skin, Subcutaneous Tissue and Breast | -3 | -14 | -32 |
| MDC 10 Endocrine, Nutritional and Metabolic Diseases and Disorders | +6 | -18 | -37 |
| MDC 11 Diseases and Disorders of the Kidney and Urinary Tract | +7 | -15 | -21 |
| MDC 12 Diseases and Disorders of the Male Reproductive System | +2 | -8 | -30 |
| MDC 13 Diseases and Disorders of the Female Reproductive System | +3 | -11 | -26 |
| MDC 14 Pregnancy, Childbirth and the Puerperium | No changes | -13 | -9 |
| MDC 15 Newborns and Other Neonates | +5 | -6 | -10 |
| MDC 16 Diseases and Disorders of the Blood and Blood Forming Organs and Immunological Disorders | +1 | -2 | -22 |
| MDC 17 Neoplastic Disorders (Haematological and Solid Neoplasms) | +6 | -13 | -10 |
| MDC 18 Infectious and Parasitic Diseases | +8 | -5 | -13 |
| MDC 19 Mental Diseases and Disorders | -11 | -25 | -27 |
| MDC 20 Alcohol/Drug Use and Alcohol/Drug Induced Organic Mental Disorder | -3 | -10 | -32 |
| MDC 21 Injuries, Poisoning and Toxic Effects of Drugs | +3 | -22 | -27 |
| MDC 22 Burns | -2 | -14 | -31 |
| MDC 23 Factors Influencing Health Status and Other Contacts with Health Services | -9 | -8 | -21 |
| MDC: Error and other DRGs | -17 | -15 | -36 |

Source: CHIF, InEK, IHACPA, AIHW, Authors calculations

## Difference in activity in COVID-19 related DRGs in Croatia (2019 vs 2020)

| | DRG Class | 2019 Case numbers all hospitals | 2020 Case numbers all hospitals | % Change all hospitals |
|---|---|---|---|---|
| A06Z | Tracheostomy Or Ventilation>95 | 3,388 | 3,916 | 16% |
| E40Z | Resp Sys Dx + Ventilator Suppt | 347 | 483 | 40% |
| E41Z | Resp Sys Dx +Non-Invas Ventiln | 874 | 713 | -19% |
| E62A | Respiratory Infectn/Inflamm+Ccc | 2,031 | 2,255 | 11% |
| E62B | Respiratory Infectn/Inflam+Smcc | 7,953 | 10,992 | 38% |
| E62C | Respiratory Infectn/Inflamm-Cc | 5,128 | 6,174 | 20% |
| | **TOTAL** | **19,721** | **24,533** | **24%** |

Source: CHIF; Authors calculations

## Most common principal diagnosis in Germany (2019 vs 2020)

| ICD-10 Code | Principal Diagnosis (2019) | ICD-10 Code | Principal Diagnosis 2020) |
|---|---|---|---|
| Z38.0 | Einling, Geburt im Krankenhaus | Z38.0 | Einling, Geburt im Krankenhaus |
| S06.0 | Gehirnerschütterung | S06.0 | Gehirnerschütterung |
| I10.01 | Benigne essentielle Hypertonie: Mit Angabe einer hypertensiven Krise | I50.01 | Sekundäre Rechtsherzinsuffizienz |
| I50.01 | Sekundäre Rechtsherzinsuffizienz | N39.0 | Harnwegsinfektion, Lokalisation nicht näher bezeichnet |
| I48.0 | Vorhofflimmern, paroxysmal | I10.01 | Benigne essentielle Hypertonie: Mit Angabe einer hypertensiven Krise |
| I50.14 | Linksherzinsuffizienz: Mit Beschwerden in Ruhe | I50.14 | Linksherzinsuffizienz: Mit Beschwerden in Ruhe |
| M17.1 | Sonstige primäre Gonarthrose | I48.0 | Vorhofflimmern, paroxysmal |
| R55 | Synkope und Kollaps | M17.1 | Sonstige primäre Gonarthrose |
| N39.0 | Harnwegsinfektion, Lokalisation nicht näher bezeichnet | O80 | Spontangeburt eines Einlings |
| I21.4 | Akuter subendokardialer Myokardinfarkt | I21.4 | Akuter subendokardialer Myokardinfarkt |
| M16.1 | Sonstige primäre Koxarthrose | M16.1 | Sonstige primäre Koxarthrose |
| O80 | Spontangeburt eines Einlings | I50.13 | Linksherzinsuffizienz: Mit Beschwerden bei leichterer Belastung |
| E86 | Volumenmangel | R55 | Synkope und Kollaps |
| I50.13 | Linksherzinsuffizienz: Mit Beschwerden bei leichterer Belastung | E86 | Volumenmangel |
| I20.8 | Sonstige Formen der Angina pectoris | I20.8 | Sonstige Formen der Angina pectoris |
| % Total number of cases | 13.76% | | 14.26% |

Source: InEK (2024)

# Neoplasms related admissions (C00-D48)

| | Germany | Croatia |
|---|---|---|
| 2019 | 2,022,521 | 67,208 |
| 2020 | 1,827,142 | 79,503 |
| Change (%) | -10% | -15% |

Source: InEK; CHIF (2024), Principal diagnosis only taken into consideration (C00-D48)

# Reviews

- Important topic, some of the data sets might impact the quality of the analysis.

- Would be interested in seeing the paper to see if the analyses back up the common view of how Australia faired in comparison to other countries.

- A comparison on how well each countries classification system performed in identifying COVID admissions would be interesting.

# Conclusions

- **Predictive value of DRG based comparative analyses**

"Australia is among only 32 countries and territories, out of 204 studied, to record an increase in life expectancy across the first two years of pandemic.„

Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950-2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analyses for the Global Burden of Disease Study 2021 (The Lancet March 2024).

The European Groundshot Commission analysed data on the impact of the COVID-19 pandemic across Europe and found that clinicians saw 1-5 million fewer patients with cancer in the first year of the pandemic, with one in two patients with cancer not receiving surgery or chemotherapy in a timely manner.

- **The COVID-19 pandemic highlighted the need for timely and comprehensive data collection and reporting**

Use of demographic and clinical data collected for each episode of care should be extended beyond budget planning and payment purposes and serve as the transformative, driving force to make better informed policy choices in the future.