Project Title

Evaluation of a Novel Population Needs-Based Sub-Segmentation Model (NBSSM) in Singapore

Project Lead and Members

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Organisation(s) Involved

Yishun Health, National Healthcare Group

Healthcare Family Group(s) Involved in this Project

Healthcare Administration

Applicable Specialty or Discipline

Insights & Analytics, Corporate Development

Project Period

Start date: Oct 2020

Completed date: On-going

Aims

In order to enable system and services planning capabilities to direct targeted interventions to meet residents needs and improve population health outcomes, building upon NHG River of Life segmentation approach, Yishun Health (YH) developed and evaluated a person-centred and Needs-based Sub-Segmentation Model (NBSSM) for residents in Yishun Zone who are Living with Illness and Living with Frailty.

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Lessons Learnt

1. Most segmentation models are disease-base or utilization-only which are not able to segment population by residents' holistic needs and provide actionable insights to direct targeted interventions to meet their needs.

2. Data available in healthcare institutions electronic database is limited. In order to develop a segmentation model based on population needs, have to use surrogates or collect more data especially for social needs.

Conclusion

See poster appended/ below

Additional Information

As data available in existing administrative database is limited, next step is to use data collected from Population Health Survey conducted by Yishun Health to enhance the NBSSM.

Recipient of the Singapore Health & Biomedical Congress (SHBC) 2022: Best Poster Award (Health Services Research) (Posters category) – (Merit Award)

Project Category

Care & Process Redesign

Value Based Care, Operational Management, Data Analytics

Keywords

Segmentation Model, Sub-Segmentation Model, Person-Centred, Needs-Based, Bio-Psycho-Social, Evaluation, Outcomes

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Yishun Health
National Healthcare Group

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Background

Population segmentation models are often used to stratify patient groups for service planning. These are typically disease- or utilisation-based, or target high-risk patient groups. Building upon NHG River of Life segmentation approach, Yishun Health (YH) developed a Needs-based Sub-Segmentation Model (NBSSM) based on biological, social, and psychological needs for residents in Yishun Zone (YZ) who are Living with Illness and Living with Frailty. We evaluated NBSSM's ability to segment residents into distinct groups, i.e. risk for types of person-centred outcome measures.

Methods

YZ residents were first segmented based on their chronic illness and frailty status to generate Living with Illness and Living with Frailty segments. Residents known to YH were further segmented into 10 sub-segments, each representing a different level of needs-based on factors such as disease complexity i.e. number and severity of chronic diseases, as well as presence of mental illness and social issues.

Table 1: Needs-Based Sub-Segmentation Model (NBSSM) Matrix

		A: OCP for Early Illness Without complications based on DRG	**B: OCP for Advanced Illness** With complications based on DRG
1	Single Chronic Illness	**A1)** 1 Chronic Disease (ICD) only	**B1)** 1 Chronic Disease (ICD) only
2	Multiple Chronic Illness	**A2)** • >1 Chronic Diseases (ICD) • No mental health issue • Not seen by MSW and not stay in rental blocks	**B2)** • >1 Chronic Diseases (ICD) • No mental health issue • Not seen by MSW and not stay in rental blocks
3	Multiple Chronic Illness + Mental	**A3)** • >1 Chronic Diseases (ICD) • ≥ 1 mental health issues (ICD) • Not seen by MSW and not stay in rental blocks	**B3)** • >1 Chronic Diseases (ICD) • At least 1 mental health issues (ICD) • Not seen by MSW and not stay in rental blocks
4	Multiple Chronic Illness + Social	**A4)** • >1 Chronic Diseases (ICD) • No mental health issues • Seen by MSW or stay in rental blocks	**B4)** • >1 Chronic Diseases (ICD) • No mental health issues • Seen by MSW or stay in rental blocks
5	Multiple Chronic Illness + Mental + Social	**A5)** • >1 Chronic Diseases (ICD) • At least 1 mental health issues (ICD) • Seen by MSW or stay rental block	**B5)** • >1 Chronic Diseases (ICD) • At lest 1 mental health issues (ICD) • Seen by MSW or stay in rental blocks

To evaluate NBSSM, we studied its ability to segment residents into distinct groups based on risk for types of person-centred outcome measures starting with readily available data first e.g. Charlson Comorbidity Index (CCI), healthcare utilisation, and cost; as well as the statistical distinction between NBSSM segments based on the same outcomes.

Results

All 314,522 YZ residents were included for segmentation, of which 53,653 patients known to YH were further sub-segmented by the NBSSM by their Bio-Psycho-Social needs.
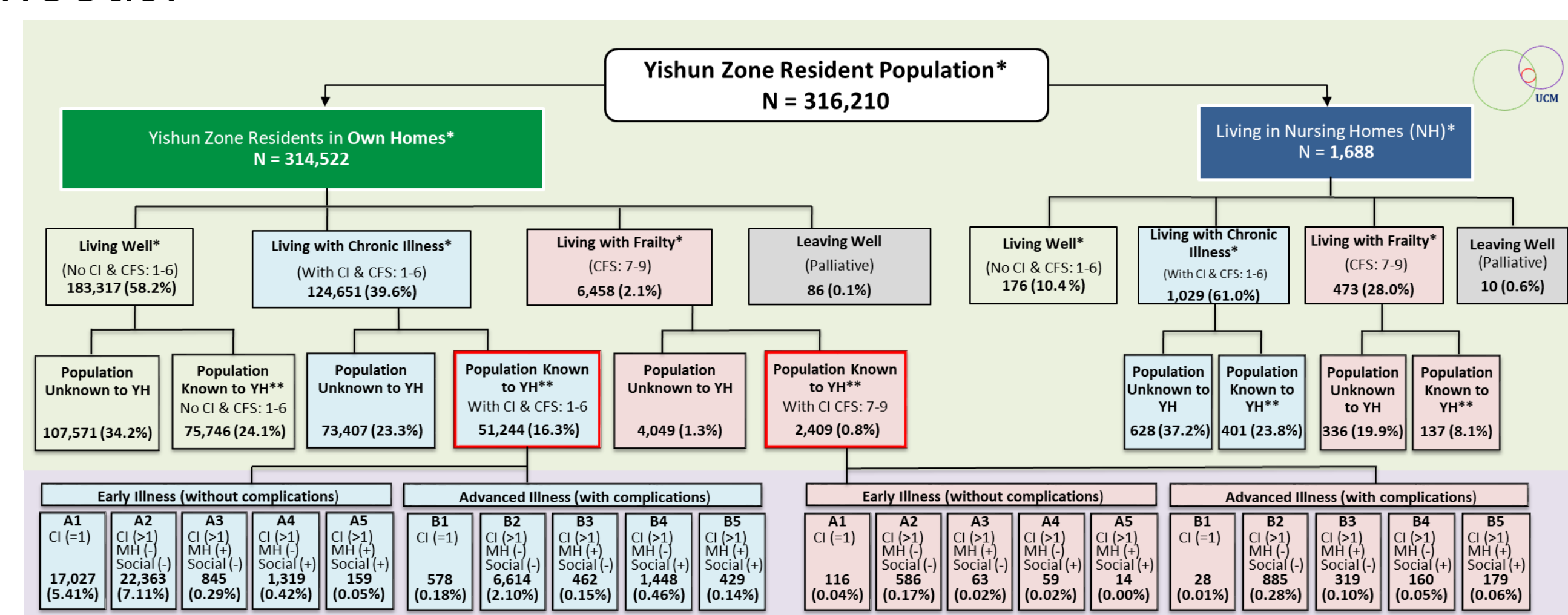

Figure 1: Segment and Sub-segment Yishun Zone population

Results (Continued)

By comparing CCI, healthcare utilisation i.e. ED/SOC visits, bed days, admissions, and annual cost, resident health needs were found to be statistically different across NBSSM segments (p<0.05).
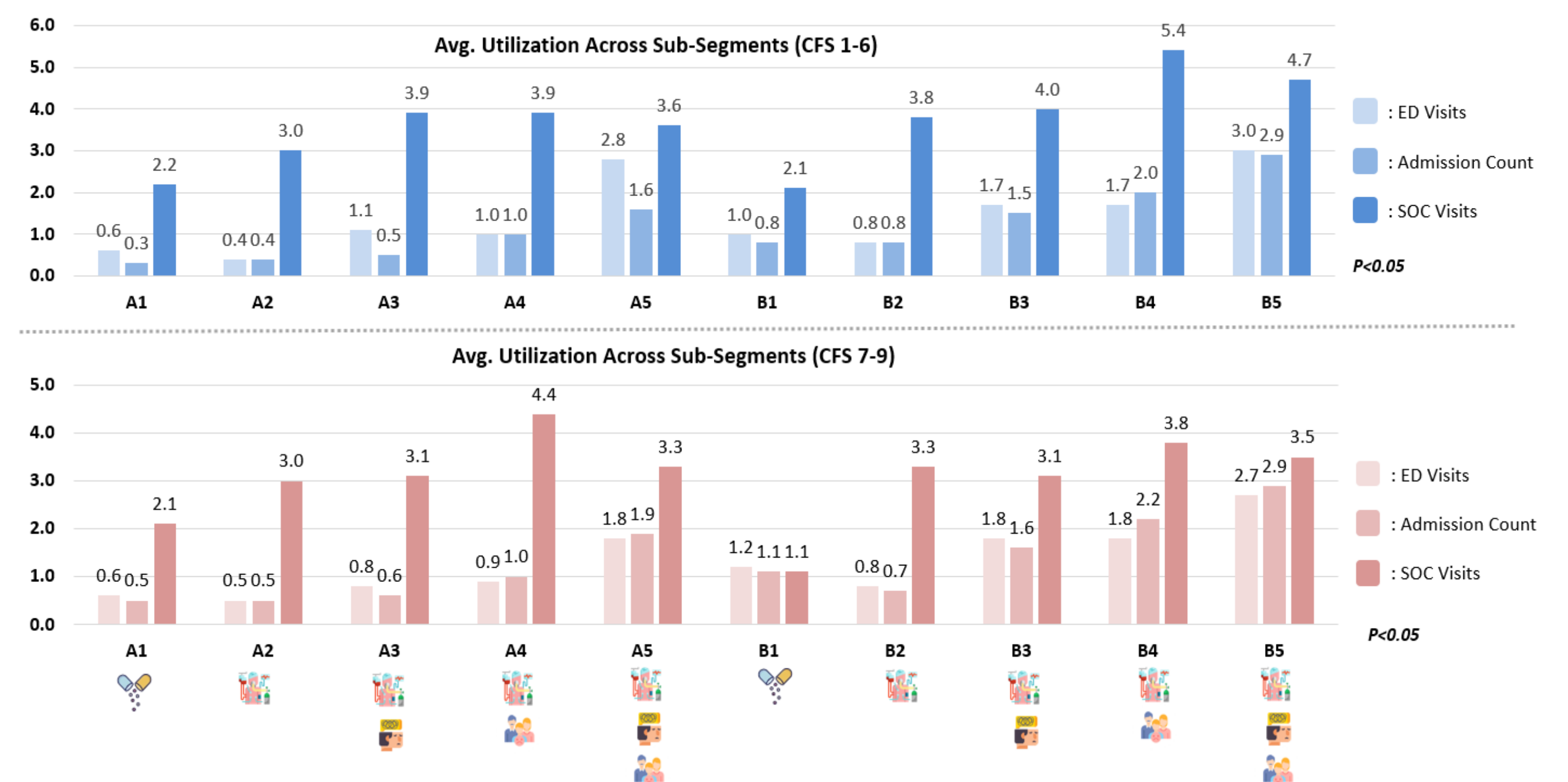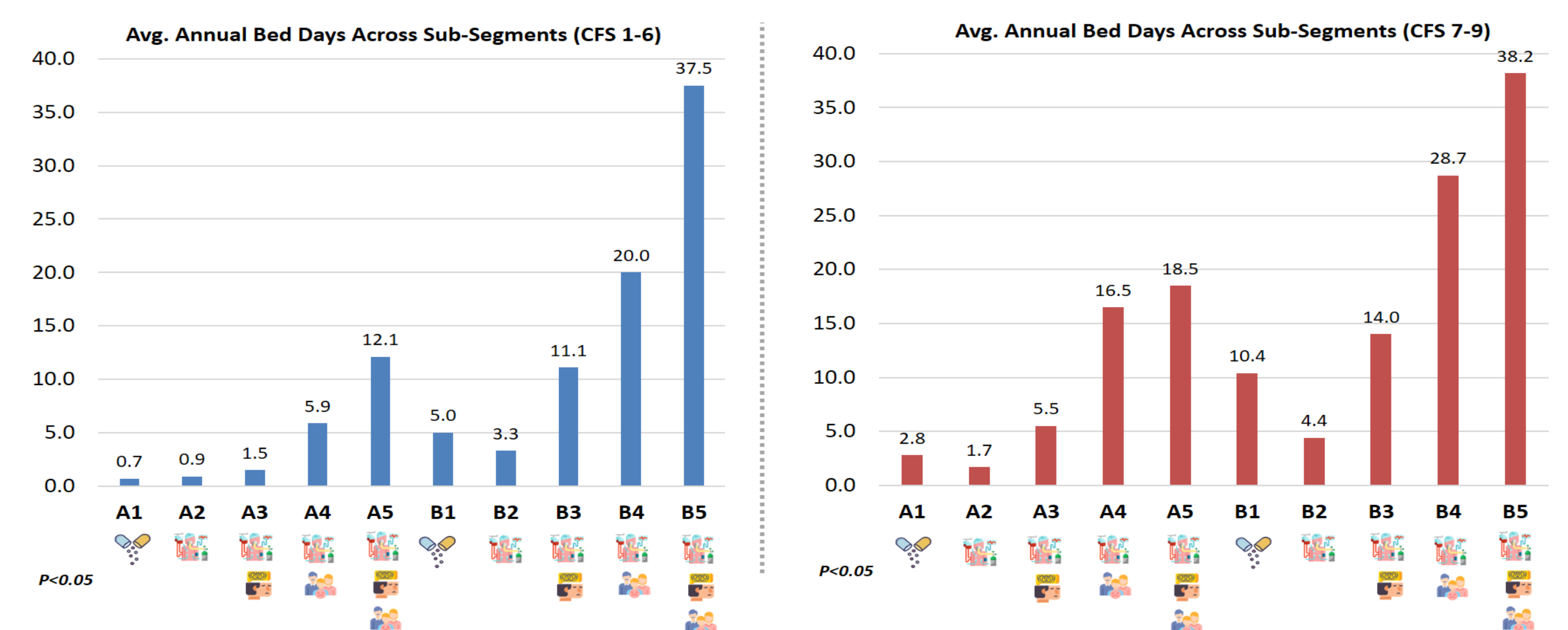

Figure 2: Hospital Utilization by Sub-Segments

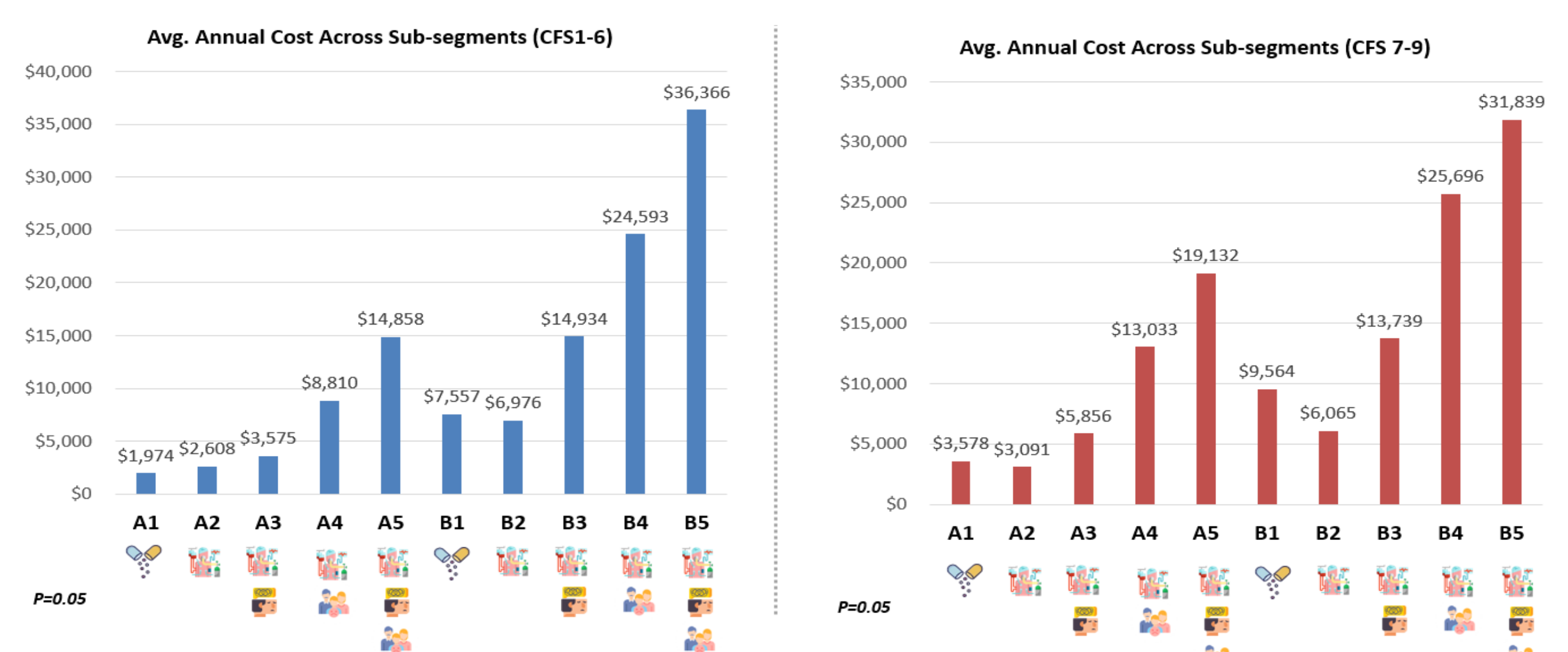Figure 3: Average Annual Bed Days by Sub-Segments

Figure 4: Average Annual Cost by Sub-Segments

Discussion and Conclusion

Using the YH NBSSM to augment NHG River of Life was effective in segmenting the YZ resident population into mutually exclusive and collectively exhaustive groups with similar magnitude of risk and type of health needs and outcomes for health system and services planning. Needs-based segmentation models are more person-centered than disease- or utilization-only segmentation models. NBSSM enhances our health system's system and services planning capabilities to direct more targeted interventions to meet resident needs and improve population health outcomes.

References

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2. Low LL, Yan S, Kwan YH, et al. Assessing the Validity of a Data Driven Segmentation Approach: A 4 Year Longitudinal Study of Healthcare Utilization and Mortality. PLoS ONE 13(4):e0195243