

A preliminary examination of organizational faultlines in a biosafety context

by

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B.A., University of Colorado, 2021
M.S., Kansas State University, 2025

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Abstract

Organizational faultlines, or hypothetical dividing lines that split groups into subgroups (Lau & Murnighan, 1998), pose a unique threat to organizations in that they can lead to conflict, decreased performance, influence team sense-making processes, and sometimes team dissolution (Lau & Murnighan, 1998). Faultline research has largely focused on demographic faultlines (Thatcher & Patel, 2012). However, according to Social Identity Theory (Tajfel & Turner, 1986), faultlines may also form based on non-demographic characteristics. The current study aims to serve as a preliminary examination of non-demographic faultlines in high-risk, biosafety facilities with a novel approach to faultline measurement, advocating finite mixture modeling approaches, specifically latent profile analysis (LPA), for identifying underlying profiles in existing data in contexts where prevention is vital. This study measured non-demographic faultlines and group outcomes based on employees' self-reports in a large biosafety facility. It was hypothesized that LPA would be an appropriate method to identify dormant faultlines and statistically significant differences between subgroups, that subgroups would be distinct, but have high within-group agreement, that faultlines would influence measurement invariance such that it was not achieved due to impact on sense-making, and that groups with high alignment would have high scores on group outcomes. Results support the use of LPA to identify dormant faultlines, that groups are homogenous and distinct from others, and that highly aligned groups had greater group outcomes. However, results did not indicate that faultlines influence measurement invariance. Implications include that LPA is an appropriate measurement method, especially in contexts where prevention is important, that highly aligned groups should have better outcomes, and that observed group differences may not be due to measurement effects.

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Dedication

For my parents, who worked harder than I did to get me here, thank you.

Chapter 1 - Introduction

Lau and Murnighan introduced the concept of organizational faultlines in 1998. At this time, the field of Industrial/ Organizational Psychology was greatly interested in teams but faced conflicting results regarding the belief that diverse workforces should be largely beneficial to work outcomes (Gover & Duxbury, 2012; Thatcher et al., 2024). The concept of organizational faultlines, and its new avenue of research, helped elucidate why such divergent results were being found, highlighting the impact of attribute alignment on team functioning (Thatcher et al., 2024). Faultline research addresses mixed findings in diversity research, explaining that diverse groups split into homogenous subgroups, thereby leading to multiple homogenous groups that may reduce performance and lead to communication breakdowns, rather than one unified, more diverse group (Thatcher & Patel, 2012). Though faultline research has burgeoned over the 28 years since its introduction, we don't yet have a firm understanding of faultline effects or how and when they lead to behavioral change (Thatcher et al., 2024).

Organizational faultlines are hypothetical dividing lines that split groups into subgroups and can be based on demographics or other attributes (Lau & Murnighan, 1988). Much like geographical faultlines, organizational faultlines can have marked negative impact once they become active. For example, faultlines can result in tensions that impair cohesion, collaboration, coordination, and cooperation, which may accelerate subgroup conflict, especially if they are related to team tasks (Lau & Murnighan, 1998). Subgroup identification can increase over time if polarization continues, sometimes leading to team dissolution (Lau & Murnighan, 1998). Faultlines might also impact various organizational climate perceptions, since such perceptions often depend on group alignment, shared mental models, and shared sensemaking; faultlines can

negatively impact the sensemaking process by disrupting necessary contextual and social interactions, thereby hindering group climate formation (Beus et al., 2012; Beus et al., 2023).

Faultline research has largely focused on demographic faultlines (Thatcher & Patel, 2012) in line with larger research trends of the twenty first century. However, according to theoretical underpinnings of faultline research, non-demographic faultlines can also form; any type of dissimilarity can serve as a faultline, as long as differences in alignment are present (Meyer et al., 2011; van Knippenberg et al., 2004). These types of faultlines have been largely overlooked in occupational research compared to demographic faultlines (Thatcher & Patel, 2012), which has created a gap in research. Limiting faultlines to diversity research restricts their utility in explaining subgroup formation processes (Thatcher & Patel, 2012). In fact, recent research has called for the need to examine faultlines by type and by whether they are dormant or active (Thatcher et al., 2024), highlighting a need to identify dormant faultlines even though they may not pose an immediate threat to organizations.

In organizational contexts where safety is paramount, such as a biosafety facilities and/ or high-reliability organization (HRO), understanding the impact of non-demographic faultlines, such as informational, resource, or social faultlines could be critical to ensuring safe operation. Faultlines, even when dormant, can serve as potential disruptions in highly complex systems, which carries immense implications for safety and risk management. Though faultlines can technically serve as latent failures, in line with the Theory of Active and Latent Failures (Reason, 2000), safety research has largely overlooked them, save for the context of hospitals. However, some research has suggested that psychological safety, and therefore safety climate, may be impacted by faultlines. For example, differences in both demographics and personality alignments may decrease psychological safety over time since team structures are important to

social identities and communication and effectiveness (Edmondson, 1999; Lau & Murnighan, 2005), preventing shared positive safety climate perceptions (Gerlack & Gockel, 2022; Lau & Murnighan, 2005). Alternatively, teams with high psychological safety may see reduced negative effects of faultlines because high psychological safety may act as a buffer against differing alignment in other areas, resulting in reduced impact on safety climate (Du et al., 2021; Chen et al., 2017; Creon & Schermuly, 2019).

Research has also highlighted that faultlines are associated with perceptual inequivalence, resulting in different perceptions of safety climate (and other climate profiles) within teams, which has implications for organizational climate measurement (Beus, 2012; Xu et al., 2018). Specifically, faultlines might decrease safety climate strength, or the extent to which climate perceptions are consistent across group members (Schneider et al., 2002), which may have negative consequences for group outcomes such as organizational commitment, productivity, accidents, and profits (González-Romá et al., 2002; He et al., 2023; Lee, 2022). Because faultlines divide members into subgroups, they can undermine shared understanding and agreement about safety priorities, thereby weakening climate strength and leading to poorer organizational outcomes. Considering both the comparative lack of research concerning faultlines in safety contexts, an overemphasis on demographic faultlines, and faultlines' noted negative effects, the current study focuses on examining non-demographic faultlines that may arise in high-risk facilities due to identity alignments, perceptions of resources, and informational differences.

Additionally, faultlines are generally measured with specific faultline categorization measures, but this type of measurement often assumes that organizational members perceive faultlines, which may not always be the case; faultlines can exist regardless of whether

organizational members can readily identify them (Thatcher & Patel, 2012), especially if such faultlines are due to deep-level differences (Zhang & Chen, 2023). These techniques also focus largely on identifying faultline strength, rather than faultlines themselves. Alternative techniques, such as finite mixture modeling may offer a promising approach in exploring faultlines compared to traditional methods, especially for those that aren't actively perceived by group members. This may be beneficial in situations where there are no obvious indications of possible faultlines (McLachlan & Basford, 1988; Srour & Karkoulian, 2022) and high-risk industries where identifying faultlines as a preventative measure could prevent downstream failures. Though clustering techniques are included under the finite mixture modeling umbrella and may be useful in faultline measurement (Lawrence & Zyphur, 2011; Meyer et al., 2014), latent profile analysis (LPA) has not been used to identify faultlines. LPA provides utility because it doesn't require a-priori identification of faultlines and can be applied in situations where faultlines aren't explicitly expected, or to existing organizational data. Thus, LPA would be especially useful in identifying dormant faultlines and mitigating the risk of activation. Therefore, the current study aims to serve as a preliminary examination of non-demographic faultlines in a safety-critical context with a novel approach to faultline measurement.

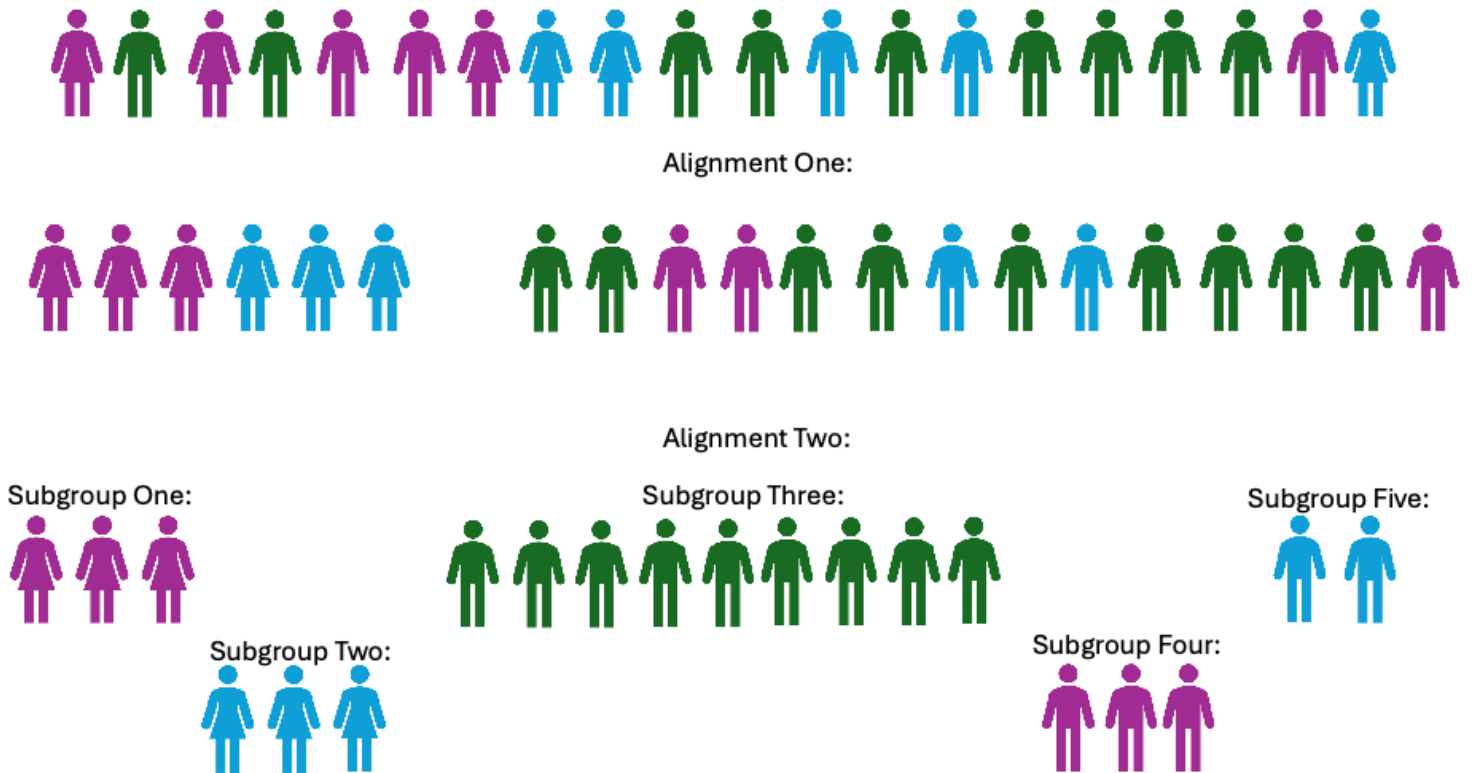
Chapter 2 - Literature Review

This chapter provides a comprehensive overview of existing faultline literature, a review of the variables of interest and how they have functioned as organizational faultlines in prior research, and an introduction to biosafety facilities and HROs to provide some background for the importance of alignment in organizations where risk prevention is vital.

Organizational Faultlines

According to faultline theory, faultline formation is dependent on the alignment of individual characteristics, and demographic subgroups are most likely to form during teams' "forming" stages (Lau & Murnighan, 1998), since demographics are more easily discerned than other characteristics. Subgroup formation is not limited to demographic attributes, but most faultline research has overlooked non-demographic faultlines (Thatcher & Patel, 2012), since its initial conceptualization focused on demographics to explain discrepancies or unexpected findings in diversity research (Lau & Murnighan, 1998). Faultline research adopts an alignment approach, examining subgroup formation based on overlapping similarities. For example, subgroups may form based on similarities in both gender and education level, which could lead to group branching. In contrast, a dispersion approach, like that typically used in more general diversity research, examines how member attributes distributed within a group may influence group outcomes (Bezrukova et al., 2007). For example, it may focus on how gender differences relate to performance. Therefore, faultline research differs from diversity research in that group alignment takes precedence over diversity composition when considering subgroup formation (Bao et al., 2024) and it considers multiple attributes, including non-demographic, deep-level variables (Deng et al., 2025). Additionally, faultline research tends to have a smaller scope, focusing on within-group differences (Meyer et al., 2014). Figure 1 illustrates a simple example of how faultlines may form based on multiple alignments.

Figure 1. Simple Illustration of Multiple Group Alignment Leading to Subgroup Formation



Practically, organizations should care to identify and prevent or mitigate effects of faultlines because they so often lead to group divisiveness and/or organizational conflict (O’Leary & Mortensen, 2010; Thatcher & Patel, 2014; Thatcher et al., 2024), which can have negative implications for both individual and organizational performance, interaction quality, and organizational effectiveness (Bezrukova et al., 2009; Lau & Murnighan, 2005; Thatcher & Patel, 2012). Research has indicated that the effects of demographic faultlines may be counteracted by increasing pro-diversity beliefs, but others, such as informational faultlines, cannot be combatted in this way, usually because of a root in knowledge disparities (Homan et al., 2007). Since non-demographic faultlines are not inherently linked to apparent individual differences, making them difficult to detect and under-researched, their mitigation is not yet understood. Still, recent

metanalytic evidence (Thatcher et al., 2024) has clarified some effects of faultlines, indicating that dormant demographic faultlines are associated with active faultlines. Additionally, though dormant faultlines are not necessarily harmful to performance, once they become active, they may be more harmful than previously thought. Thatcher et al. (2024) recently found evidence that activated faultlines have more pronounced negative effects than previous research has suggested. Activated faultlines are associated with more conflict, less information elaboration, and lower team performance and satisfaction than previously believed (Thatcher et al., 2024), suggesting an increased negative impact on team outcomes. Additionally, faultlines may result in uneven or multiple subgroup formation, which can create imbalances in power, resources, or abilities across subgroups (Lau & Murnighan, 2005). As such, they serve as an important area of research that could practically prevent negative team results.

Theoretical Underpinnings of Faultlines

The idea that hypothetical dividing lines can create subgroups isn't necessarily novel; much social psychology research has indeed stemmed from theories with this basic principle. Lau and Murnighan's faultline theory was partially informed by social psychology theories (Thatcher & Patel, 2012), but has a more specific scope, focused specifically on a work context. Perhaps most notably, Lau and Murnighan drew from Social Identity Theory (SIT; Tajfel & Turner, 1986). According to SIT, group membership is based on characteristics that lead to ingroup and outgroup categorization. According to Lau and Murnighan (1998), this is the essence behind faultlines; subgroups form based on the alignment of individual characteristics, essentially leading to ingroups and outgroups (subgroups) with differing compositions.

However, faultline researchers have broadened their scope to include categorization theories, including Self-categorization theory (SCT; Turner, 1987), the Categorization-elaboration Model

(CEM; van Knippenberg et al., 2004), and cross-categorization (e.g., Crisp et al., 2006).

Categorization theories can be useful in explaining subgroup formation, as they also include in-group and out-group processing, with some key differences. Categorization and elaboration theories state that teams can engage in both differentiation and elaboration (i.e., finding similarities). Specifically, CEM supposes comparative fit, based on both attribute grouping and information elaboration; in-groups are created under the same assumptions of SIT, but information elaboration may help to overcome this in grouping. The utility of CEM in faultline research is that it allows for context-specific predictions, which fosters an understanding of both positive and negative faultline outcomes under different conditions (e.g., Spoelma & Ellis, 2017). In fact, much faultline research has adopted CEM (e.g., Cooper et al., 2014; Ellis et al., 2013; Ma et al., 2022; Qi et al., 2022a; Spoelma & Ellis, 2017) because it suggests that any type of variety may lead to social categorization, if said variety affects elaboration and categorization processes. In other words, any difference in alignment, including non-demographic differences, may lead to group fracture. SCT (Turner, 1987) takes this same categorization approach, but with a locus focused on the self. SCT may explain faultline formation because it highlights how salient, or perceived, differences between oneself and others can lead to in-grouping with the same mechanism as CEM.

In contrast, Cross-categorization theories may be employed to reduce the effects of active faultlines (Crisp et al., 2006). Cross categorization, or identifying with dissimilar groups or individuals, may reduce the potential of alignment for subgroup formation. Subgroup similarities could help overcome negative effects of active faultlines (Thatcher & Patel, 2012), though this may not be as effective for groups with strong faultlines (Lau & Murnighan, 2005). Cross-categorization occurs with demographic similarities across subgroups, reducing psychological

distance between social categories (Bezrukova et al., 2009). Cross-categorization might therefore reduce the potential for subgroup formation because it allows for more elaboration and less differentiation. Each of these theories relates to group alignment, and might explain how different faultlines form, and therefore how to prevent them. See Figure 2 for a simple example of how cross-categorization may reduce subgroup formation, based on the organization from Figure 1.

Figure 2. Simple Illustration of Cross-Categorization Reducing Subgroups

Organization:



Alignment One:



Alignment Two:

Subgroup One:



Subgroup Two:



Subgroup Three:



The mechanism behind faultline formation also aligns with Optimal Distinctiveness theory (Brewer, 1991). This theory states that individuals wish to balance their assimilation and distinction within and between groups, which may explain why subgroups form based on individual alignments; people wish to be part of a group that they personally identify with and

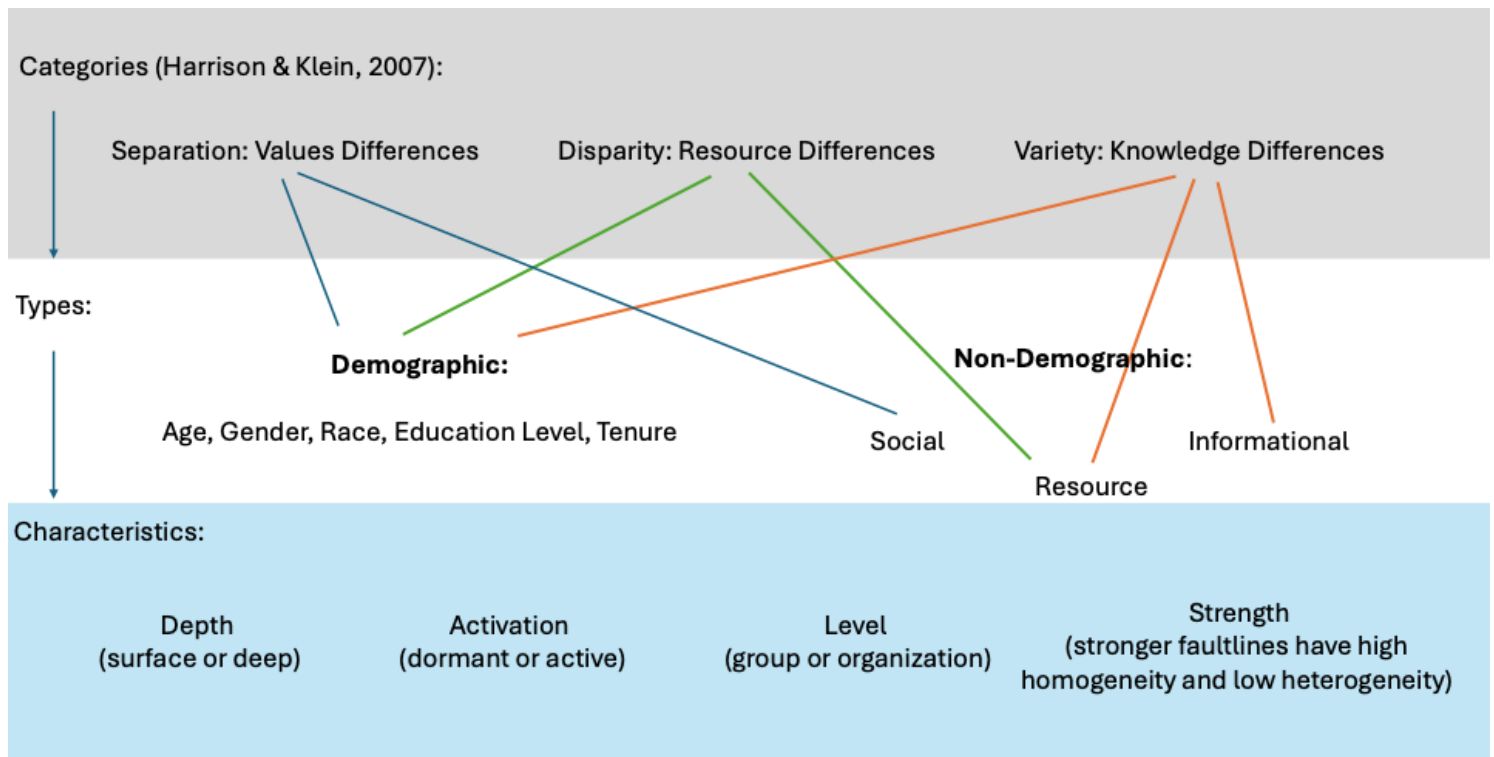
distinct from groups that they don't identify with. Optimal Distinctiveness theory might explain why faultlines can occur both within groups and across organizations (Thatcher & Patel, 2012). At the organizational level, people wish to balance their assimilation and distinction within and between groups, so they may choose (even subconsciously) to identify more with individuals or teams that have a similar knowledge base to theirs and less with individuals or teams that don't. In this case, subgroups could form based on knowledge alignments, which might create siloed units that don't get along.

Faultline Categories, Types, and Characteristics

Subgroups are subsets of two or more team members characterized by a unique interdependence. According to Carton and Cummings (2012), types of subgroups broadly include identity-based (e.g., cliques, social subgroups, relational subgroups), resource-based (e.g., coalitions, alliances, factions), and knowledge-based subgroups (e.g., cohorts, informational subgroups, task-related subgroups). Identity-based subgroups form largely based on social identity, whereas resource-based subgroups form due to access to resources such as materials, and knowledge-based subgroups form mostly because of differences in technical background (Carton & Cummings, 2012). These subgroups are broadly considered types of faultlines in faultline research; faultlines may form due to alignments in social identity, knowledge, and resources. Faultlines tend to form according to three major axes, in line with general subgroup research: separation, disparity, and variety (Harrison & Klein, 2007). Faultlines can be split into non-demographic and demographic types, each of which may differentially relate to the three major categories. Finally, faultlines tend to be characterized by depth, activation, level, and strength. These are presented and discussed in the following sections, and Figure 3 provides a visual summary of the categories, types, and characteristics and examples of

relationships between categories and types, though these connections are not exhaustive. It should be noted that categories and types may be interrelated, and their separation in Figure 3 is based on the dominant relationships between categories and types, for ease of understanding. For example, disparity may relate to both resource faultlines and social faultlines, and variety could be related to both informational and demographic faultlines (i.e., education level).

Figure 3. Visual Summary of Faultline Categories, Types, and Characteristics



Faultline Categories

In general, three categories of faultlines are thought to lead to subgroup formation, based on the larger body of subgroup research: separation, disparity, and variety (Carton & Cummings, 2012; Harrison & Klein, 2007). Separation refers to a horizontal trait continuum related to values, disparity is a vertical trait continuum related to resources (e.g., power or pay), and variety refers to team members' distinct knowledge, information processing, and experience. Strong

separation can promote segregation through horizontal subgroup formation based on attitudes or values, whereas strong disparity could lead to vertical subgroup formation based on resources, resulting in power imbalance within teams. In contrast, strong variety can counteract subgroup formation by increasing functional differences within teams (Harrison & Klein, 2007). These categories are not mutually exclusive – for example, cultural values may be indicative of both separation and variety, which can create multiple subgroups with differing levels of power. Organizational context is important in determining whether different attributes function as separation, variety, or disparity (Harrison & Klein, 2007), and sometimes they can cooccur. For example, in organizations where specialized teams are necessary, subgroups may naturally form based on variety (knowledge differences). However, in organizations where teams are meant to be cross-functional, subgroups may naturally form based on the same characteristic (knowledge differences), but this might be categorized as disparity.

Faultline Types: Demographic Faultlines

The broad categories of separation, disparity, and variety explain general subgroup formation. Faultline research highlights several specific characteristics that fall under these categories – and sometimes may overlap – to explain how multiple alignment may emerge in subgroups. Most research has focused on demographic alignment (e.g., Bezrukova et al., 2009; Leicht-Dobald et al., 2021; Lau & Murnighan, 2005) since it was the guiding trend in faultline research. A meta-analysis by Thatcher and Patel (2012) suggested the demographics that are most researched in relation to faultlines include age, race, education, tenure, and gender, and this pattern seems to have held for decades (e.g., Bezrukova et al., 2009; 2016; Boyraz, 2019; Choi & Sy, 2010; Carton & Cummings, 2013; Chung et al., 2020; Creon & Schermuly, 2019; Crucke & Knockaert, 2016; Hutzschenreuter & Horstkotte, 2013; Jehn & Bezrukova, 2010; Kwon & Lee,

2020; Lau & Murnighan, 2005; Li & Hambrick, 2005; Li & Jones, 2019; Pearsall et al., 2008; Valls et al., 2021; Zhang et al., 2017). According to Meyer et al. (2014), faultline research based on demographics differs from most diversity research in that it is more focused on the micro level (within and inter-subgroup differences). Actual demographic differences may have reduced effects on faultline activation compared to perceived differences (Zellmer-Bruhn et al., 2008). In other words, faultline research focuses on micro-level demographic differences and places emphasis on perceptions and multiple alignment, unlike diversity research, which may focus on more general, actual differences.

Faultline Types: Non-Demographic Faultlines

Though demographic faultlines have received much attention in the literature, non-demographic faultlines are just as important to research based on their negative outcomes, but have been heavily overlooked, highlighting an area in need of attention (Thatcher & Patel, 2012). Understanding potential non-demographic faultline attributes is integral because it may highlight the mechanisms by which they operate, as well as their varying magnitudes and effect timing (Meister et al., 2019). Usually, non-demographic faultlines form based on discreet identities, resources, or task knowledge (Meyer et al., 2014). Devoting more attention to these types of faultlines, either on their own or in combination with demographic faultlines, is worthwhile because demographic faultlines tend to remain constant over time, while other types have the potential to change and explain differences in group processes (Park et al., 2023; Thatcher & Patel, 2012; Thatcher et al., 2024).

Social Faultlines

Social faultlines are those that may split groups into subgroups based on attributes related to a social identity, such as gender (Bezrukova et al., 2009). However, social categories do not

always equate to demographic faultlines, especially when these social categories are imperceivable (Meyer et al., 2011). For example, differences in personality alignments such as narcissism, conscientiousness, neuroticism, and agreeableness trait alignments may serve as faultlines even though these are more difficult to perceive (Emich et al., 2022; Gratton et al., 2007; Molleman, 2005; Rico et al., 2007). Additionally, employment status and having children can create faultlines (Vora & Markoczy, 2012). Even differences in chronotypes (Volk et al., 2017) and life experiences (Spell et al., 2022) can lead to subgroup formation based on multiple alignments. Another identity-based faultline lies in relationship faultlines, which have been found to impact corporate innovation (Deng et al., 2025). One specific example lies in leader-member exchange faultlines, which form based on a social divide between leaders' preferred and non-preferred members (Bruning et al., 2022; LI & Lao, 2014; Moser et al., 2023). These faultlines (non-explicit social identities) can also result in poor intergroup dynamics and lower job satisfaction when triggered by organizational change (Grover & Duxbury, 2012), as can differences in group values (Bezrukova & Jehn, 2003). These social identities may take more time to discern than demographic variables and therefore may be deep-level faultlines.

Along with deep-level characteristics, physical location (even within an organization) can serve as natural faultlines. Geographic location, particularly relating to geographically dispersed teams (Boyraz, 2019; Chiu & Staples, 2013; Cramton & Hinds, 2005; Gratton et al., 2007; Grover & Duxbury, 2012; O'leary & Mortenson, 2010; Polzer et al., 2006;), has garnered much attention as a non-demographic faultline. An interesting case of non-demographic, identity-based faultlines related to geographic location lies in factional groups, where groups from different areas merge. Traditionally, faultline theory considers individuals and their predispositions separately in faultline formation; it assumes that individuals arrive in groups on their own, with

their individual characteristics (Beus et al., 2012; Lau & Murnighan, 1998). However, in some cases, individuals may join larger groups in factions – for example, as a group of two or three. In such cases, faultlines are predetermined based on faction identification within a larger group, sometimes leading to conflict and decreased performance (Li & Hambrick, 2005). For example, if a physically dispersed human resources unit were to condense into one physical space, factions of employees would arrive together, which may lead to subgroup formation. This illustrates how poor assimilation could possibly activate faultlines (e.g., Cramton & Hinds, 2005), and in such cases subgroup entrenchment may pose a larger threat. Physical location provides slightly more formal group distinctions compared to deep-level differences, but in some cases physical organization may be unrelated to organizational structure (e.g., in remote organizations or those working with limited physical space), making it a more hypothetical dividing line.

Resource-based Faultlines

Resource-based faultlines are those that relate to alignments in resources such as status, power, decision-making, and others (Carton & Cummings, 2012; Yao & Liu, 2023). The effects of resource-based faultlines are not widely researched (Yao & Liu, 2023), despite the fact that resources are considered critical to team outcomes (Carton & Cummings, 2012). Differences in access to resources can create faultlines (Yao & Liu., 2023), which can lead to subgroups with disparities. For example, perceptions of low LMX (compared to outgroups) may result in increased absenteeism (Moser et al., 2022). Goal faultlines are also considered resource-based faultlines and are present when there are differences in performance goals. These can be beneficial at the surface level but generally are related to lower task performance (Ellis et al., 2013). Because resources can also relate to informational attributes, like cognitive resources such

as differences in knowledge, resource faultlines may sometimes be considered informational faultlines (Bezrukova et al., 2009).

Informational Faultlines

Informational differences like education, knowledge, and organizational background are relevant to strategic decisions such as team creation, but can act as faultlines (Bezrukova et al., 2012; Qu & Liu, 2017; Thatcher et al., 2003; Zellmer-Bruhn et al., 2008). For example, even within teams with the same educational background, knowledge faultlines may arise due to language differences (Hinds et al., 2014; Kulkarni, 2015; Offermann et al., 2014), and these language-based diversity may also activate social identity-based faultlines (Kulkarni, 2015), illustrating how differences may align to form multiple faultlines. Additionally, differences in perceptions of organizational culture (Bezrukova et al., 2012) can also serve as informational faultlines, promoting subgroup identification based on experiences and perceptions of culture. Interestingly, for informationally homogenous groups, performance may be unaffected by diversity beliefs (Homan et al., 2007), and groups with informational variety may not experience separation (Harrison & Klein, 2007). This may be because informational alignment facilitates goal completion in specialized teams, superceding negative effects of faultlines (Homan et al., 2007). Informational faultlines, unlike other faultlines, also offer the benefit of specialization and labor division (Cooper et al., 2014). Task faultlines are informational faultlines that may help top-management teams juggle obligations (Hutzschenreuter & Horstkotte, 2013) and can be positive at the surface level because they allow for interdependent team formation (Deng et al., 2025; Zhang & Chen, 2023). A specific example of this lies in task faultlines. Task faultlines can include alignments in specialization, education (including educational background), experience, functional background, and ability, and have garnered much attention in research because of

their potential positive effects at the surface level (e.g., Bezrukova et al., 2009; Calabrò et al., 2021; Cooper et al., 2014; Georgakakis et al., 2017; Ma et al., 2022; Molleman, 2005; Ping et al., 2017; Qu & Liu, 2017; Rupert et al., 2016; Schölmerich et al., 2016; Zhang et al., 2017).

Informational faultlines provide a unique case, where both low and high levels of informational variety may not lead to subgroup formation because they can promote necessary cross-functional collaboration (Bezrukova et al., 2012).

Faultline Characteristics

Most research characterizes faultlines in terms of depth, strength, activity, and organizational level. In terms of depth, faultlines can be either surface or deep level (Zhang & Chen, 2023).

Surface level faultlines form based on characteristics that are easily detectable, such as demographics like age, race, gender, tenure, and education (Harrison et al., 1998). For example, surface faultlines could form within government organizations due to military background, essentially creating in-groups and out-groups based on military service (these can occur across teams), in line with SIT. In contrast, deep level faultlines form based on characteristics that aren't as readily detectable, like underlying personality traits, values, beliefs, and norms (Zhang & Chen, 2023; Harrison et al., 1998). For example, faultlines could form between those who are more introverted and those who are more extroverted, even without their knowledge, creating subgroups based on levels of sociability. Of course, faultlines could also form based on both surface and deep-level characteristics. For example, subgroups may form based on gender and age, but further split if there are also distinct alignments in sociability within these groups. Deep level faultlines indirectly affect team performance through subgroup formation and team interaction quality (Zhang & Chen, 2023), so it would benefit organizations to prevent them. Additionally, both surface and deep level social faultlines can be detrimental to team interaction

quality, while surface level task faultlines are usually beneficial to team interaction because teams generally do require slightly differentiated task knowledge in order to complete assignments (Zhang & Chen, 2023).

In addition, faultlines may be dormant or active. Dormant faultlines are those that have the potential for subgroup formation based on individual characteristics; they do not create any differences in behavior. Such faultlines may offer the benefit of greater opportunity for information elaboration (e.g., Wu et al., 2025); it is easier to employ cross-categorization techniques before subgroups have formed, and potential entrenchment has begun. These generally do not decrease performance in non- top management teams, but they are still associated with conflict (Thatcher et al., 2024) and decreased team interaction quality (Zhang & Chen, 2023). However, dormant faultlines are generally studied with respect to singular outcomes, rather than multiple team processes (Thatcher et al., 2024), meaning that we don't quite understand their full effects. On the other hand, active faultlines are created when individuals perceive group differences and these differences lead to differences in behaviors between groups (Bezrukova et al., 2002). Active faultlines are detrimental to organizations because they are related to increased conflict as well as coalition formation and decreased satisfaction and performance (Jehn & Bezrukova, 2010; Thatcher et al., 2024; Qi et al., 2022a). Though dormant faultlines can become activate, the mechanism behind why this occurs is unknown, serving as a gap in research (Thatcher et al., 2024). However, one qualitative study suggests that differential treatment, different values, humiliation, problems with assimilation, and various day-to-day contacts between potential subgroups could serve as triggers for demographic faultline activation (Chrobot-Mason et al., 2019).

Faultlines can also be multilevel, forming at either the group level or the organizational level. Group level faultlines are negatively related to group performance, while organizational faultlines negatively relate to performance and are most harmful in organizations with high compensation structures (Bezrukova et al., 2012). Additionally, faultlines vary in strength. Stronger faultlines are characterized by subgroups of similar size, high levels of homogeneity within subgroups, and high levels of heterogeneity between subgroups (Lau & Murnighan, 1998). As the number of attributes in alignment increases, so does faultline strength (Lau & Murnighan, 1998; van Knippenberg & Schippers, 2007). Strong, activated faultlines are negatively associated with performance (Bezrukova et al., 2009; Lau & Murnighan, 1998; Thatcher et al., 2024). Therefore, either preventing faultline activation or detecting and mitigating it before faultline strength increases may be critical for organizational outcomes.

Faultline Measurement

Faultline measurement is very important to its intervention, but there are several methods available, resulting in a lack of standard measurement. The face validity of faultlines is good (Lawrence & Zyphur, 2011), but measures have limitations. For example, faultline differences, or distance between members, is often overlooked (Bezrukova et al., 2009). Also, many measurement methods require some knowledge of subgroups or mechanisms that may lead to them prior to identifying faultlines (Srouf & Karkoulian, 2022). For example, some prior research has asked participants to indicate whether faultlines are present in their teams, and where (Srouf & Karkoulian, 2022). Faultline measurement is usually conducted with algorithms that were specifically developed for faultline research, meaning its utility is limited to research designed explicitly for faultline identification, which may not be feasible in an industry setting. For example, Meyer and Glenz (2013) introduced a specific tool for faultline measurement called

average silhouette width (ASW). ASW, a widely used cluster validation index, identifies the number of subgroups and subgroup measurement and is fairly accurate for two or more subgroups (Meyer & Glenz, 2013). Carton and Cummings (2013) developed the Subgroup Algorithm (SGA), which calculates faultline strength based on differences between members from different subgroups while Thatcher et al. (2003) focused on variance statistics to identify subgroup splits. Faultline distance has also been calculated as the extent of attribute alignment within certain group members and between different groups (Bezrukova et al., 2009), which is conceptually like Shaw's Faultline Score (Shaw, 2004). Other methods, such as hierarchical regression, can also be used to identify faultlines (Meyer & Glenz, 2013). Essentially, any method that allows for subgroup identification or cluster modeling can be applied.

Traditional measures of faultlines have one key limitation. They tend to rely on overt faultline identification, often using self-report to identify faultlines, which can limit measurement to perceived and/or active faultlines, and generally requires some a priori identification (Mehrioo et al., 2022; Srour & Karkouloulian, 2022). Such measures have been criticized since they do not provide utility in practical settings, as they require specific methods of data collection and a priori distinctions that may not be feasible in an organizational setting due to restrictions on resources and/ or limited knowledge of underlying dynamics (Lawrence & Zyphur, 2011). Some newer approaches to faultline measurement have attempted to leverage large, open-access data sets to identify faultlines, demonstrating that identification may not require overtly asking teams to identify faultlines (Mehrioo et al., 2022). Other methods have adopted machine learning techniques such as decision-making trees (Srour & Karkouloulian, 2022). For example, latent class cluster analysis (LCC) is an unsupervised machine learning technique that has been used to examine faultlines (Lawrence & Zyphur, 2011). Lawrence and Zyphur (2011) advocate for LCC

as an analytical tool for faultline measurement because it doesn't require a-priori identification, instead using a stepwise approach to identify existing clusters, but it doesn't account for faultline strength (Meyer & Glenz, 2013).

The current study advocates for finite mixture modeling approaches to measuring faultlines, specifically focusing on latent profile analysis (LPA), since similar techniques have demonstrated promise. Finite mixture modeling is highly flexible, which makes it useful in cases where the distributional shape is unknown, therefore providing interpretable representations of complex data (McLachlan et al., 2019). It is also applicable in situations aimed at exploring an underlying group structure in existing data, even in cases where there is no prior belief of existing structure – in fact, this is one of its principal uses (McLachlan & Basford, 1988). This method is therefore especially appropriate for identifying faultlines in high-risk settings, where it is useful to identify them for preventative purposes, even when latent subgroups are entirely unknown. Cluster analyses, such as LCC and LPA, fall under the umbrella of finite mixture models (McLachlan & Basford, 1988; McLachlan et al., 2019). Though such analyses are generally accepted as a method of subgroup measurement, LPA has not been applied to faultline research, perhaps because it has historically focused on demographic data that are oftentimes categorically classified. LPA uses continuous variables to identify latent subpopulations based on probability density functions and assumes that people can be placed into categories that share distinct configural profiles of attributes (Spurk et al., 2020). This method can provide a starting point for exploring the presence of meaningful faultlines in cases where latent problems may provide threat to organizational outcomes but aren't readily identifiable.

Faultline Implications

Generally, faultlines are associated with decreased team performance and satisfaction (Bezrukova et al., 2005; Lau & Murnighan, 2005; Thatcher & Patel, 2012). They are also broadly associated with conflict, including both task and relationship conflict (Bezrukova et al., 2007; Jehn & Bezrukova, 2010; Lau & Murnighan, 1998; Meyer & Glenz, 2013; Thatcher & Patel, 2014; Zhang et al., 2017). However, faultline research suggests that outcomes are context dependent; though there are widely accepted faultline types, their outcomes tend to vary based on context. Whether faultlines are functional is contingent on multiple factors, including the nature of faultlines and task type (Ellis et al., 2013; Homan et al., 2007), heterogeneity within subgroups (Leicht-Deobald et al., 2021), industry, occupation, and team (Joshi & Roh, 2009), threat (Mitchell et al., 2019; Spoelma & Ellis, 2017), psychological safety (Chen et al., 2017; Du et al., 2021), decision structure (Park et al., 2023), and leader activity (Chung et al., 2020; Han et al., 2023; Qi et al., 2022b), to name a few. For example, goal faultlines may be detrimental for routine tasks, but beneficial for creative tasks that require differing perspectives (Ellis et al., 2013), highlighting the importance of boundary conditions for faultline outcomes.

Attribute alignment, context, and faultline characteristics are essential for a complete understanding of faultline effects (Cooper et al., 2014). For example, regarding faultline characteristics, strong faultlines are associated with increased intragroup conflict, decreased performance and satisfaction (Bezrukova et al., 2010; 2007; Thatcher & Patel, 2012), decreased creativity (Yao & Liu, 2023), decreased organizational citizenship behavior (Chung et al., 2015; Qi et al., 2025), and can affect decision making regarding compensation (Antoons & Vandebek, 2025). Increased faultline distance is associated with negative effects in groups with social and informational faultlines (Bezrukova et al., 2009). Activated faultlines can potentially lead to

ambiguity in status perceptions, which can negatively influence team justice climate, conflict, and performance (Antino et al., 2019). Group-level faultlines have been shown to be associated with internal conflict and organizational faultlines are associated with decreased performance (Bezrukova et al., 2016). Such conflict may be driven by mistrust and dislike resulting from faultlines.

Regarding the effects of different faultline types, demographic faultlines explain more variance in perceptions of team learning, psychological safety, satisfaction, and performance than other indices (Lau & Murnighan, 2005). They are also positively associated with negative group affective tone (Chi & Tsai, 2021) and negatively associated with team performance (Chung et al., 2015). Demographic faultlines can also increase conflict among directors, which influences decision making (Shin & You, 2022; Thatcher & Patel, 2012). Additionally, strong identity-based subgroups exhibit stronger interdependence (Meyer et al., 2015). In general, demographic faultlines are associated with negative group outcomes. Informational faultlines can influence team learning in combination with other aligning attributes (e.g., Chen & Wang, 2016). They may sometimes increase conflict (Zellmer-Bruhn et al., 2008) and performance (Chen & Wang, 2021). For example, faultlines based on tenure and functional background can lead to higher performance (Bezrukova et al., 2007). These faultlines may also decrease team efficacy through inhibiting knowledge sharing (Bao et al., 2024; Homan et al., 2007; Meyer et al., 2011), but this may not always be the case (Zellmer-Bruhn et al., 2008), indicating that informational faultlines may be beneficial up to a certain threshold. Moderate informational faultlines could increase knowledge sharing because teams have informational variety but still need to communicate through knowledge gaps to achieve team goals (Carton & Cummings,

2012; Spoelma & Ellis; 2017). Therefore, informational faultlines do not always have negative impact.

Perhaps one of the most concerning effects of faultlines is their influence on climate. Faultlines have demonstrated considerable effects on organizational climate profiles, including justice and safety climates (Antino et al., 2019; Beus et al., 2012). Organizational climate refers to employees' shared perceptions of policies, procedures, practices and routines (Ostroff et al., 2003). An instance of climate that has garnered research attention is safety climate. Safety climate is a specific example of outcome-focused climates that refers to shared employee perceptions of the relative importance of safety within an organization (Schneider et al., 2017; Zohar, 1980; 2000). It is especially relevant to high-risk industries and is a strong predictor of safety behavior and performance, safety program effectiveness, and health outcomes such as injury or accidents (Beus et al, 2010; Christian et al., 2009; Neal & Griffin, 2002; Zohar, 1980; 2010). Safety climate perceptions are driven by safety policies, procedures, and practices (Zohar, 2010). Antecedents of safety climate include situational factors, coworker influence, individual differences, leadership type, and LMX (He et al., 2019; Hofmann & Morgeson, 1999; Schneider et al., 2017; Zohar, 2011). In high-risk organizations, workplace safety perceptions can be influenced by leaders and organizational values (He et al., 2019; Lee et al., 2019; Zohar, 2000). Regarding safety climate outcomes, organizations with a positive safety climate environment foster safe work behaviors, reducing risk (Zohar, 2000). Positive safety climate is also associated with greater safety compliance and participation, increased well-being, and reduced injuries and accidents (Christian et al., 2009; Clarke, 2010; Nahrgang et al., 2011). A weak safety climate might therefore lead to increased accidents and injury and reduced well-being (Clarke, 2010). Faultlines can undermine safety climate because shared perceptions are central to it (Griffin &

Neal, 2000; Zohar, 2010). This difference likely occurs because of differences in sensemaking, which is the process used to understand what behaviors organizations expect, reward, and punish (Ostroff et al., 2003). Faultlines affect the formation of safety climate perceptions through informal sense-making processes; subgroup formation along faultlines can encourage more in-group than out-group communication, influencing employee climate perceptions (Beus et al., 2012). Therefore, faultlines influence safety climate strength because they can result in subgroups with varying perceptions of safety climate based on differences in sensemaking, which can lead to a fragmented team mental model (Griffin & Curcurto, 2016; Zhang et al., 2021).

In fact, faultlines have been found to affect the measurement invariance of safety climate (Beus et al., 2012; Xu et al., 2018), negating the aggregation of individual-level scores to higher levels, which is a common assumption underlying climate measurement (Beus et al., 2012). This is concerning since measurement invariance of safety climate is essential to safety promotion (Lee et al., 2015). Though measurement research has demonstrated that faultlines may contribute to incongruencies in safety perceptions, and subsequently inconsistencies in measurement, faultlines haven't been heavily researched in relation to safety. Faultlines' effect on measurement invariance can pose a major disadvantage to researchers. If faultlines exist, measures may not function the same across groups, or even within one team, making results incomparable. This can influence climate profiles besides safety climate; faultlines have the potential to affect any group-level perception, making it hard to draw reliable conclusions about perceptions that are aggregated at higher levels. Therefore, another methodological concern for faultlines is testing for measurement invariance across faultline groups when faultlines are present to ensure that sound conclusions can be made.

Though faultlines are typically linked with negative consequences, this isn't always the case, and some research has found methods to combat these negative outcomes. Research has demonstrated that some detrimental effects of faultlines are reversed when cultures and results orientations align (Bezrukova et al., 2012), emphasizing the importance of alignment both within and between groups when considering performance; promoting within-group alignment may prevent subgroup formation. Additionally, friendship ties can reduce subgroup formation based on faultlines (Ren et al., 2015). A strong workgroup identity reduces the likelihood of negative outcomes, moderating the effect of active faultlines on organizational outcomes (Jehn & Bezrukova, 2010). Interestingly, faultlines may help reduce perceptions of injustice (Bezrukova et al., 2010). To illustrate an example, say a team splits into subgroups based on an alignment in relationships with leaders, and then further along a gender faultline, resulting in male and female subgroups with differing levels of leader relationship quality. In this case, the opportunity for women to identify with their female subgroup members may reduce their perceptions of interpersonal injustice. Additionally, based on categorization theory, cross-categorization, or identification with out-group members might decrease chances of subgroup formation based on faultlines (Crisp et al., 2006; van Knippenberg & Schippers, 2007). Alternatively, this could allow for multiple group identification, which might decrease potential negative impact of faultlines (Lau & Murnighan, 1998; 2005). For example, say subgroups form within a team along a gender faultline, but within these subgroups there are also distinct age groups. Identification with these age groups (e.g., young men and women, older men and women) might supersede gender groups so that subgroup entrenchment doesn't occur. Therefore, though there are fewer positive outcomes of faultlines than negative, faultlines may not always be harmful and in some cases their effects could be reversed with multiple group identification. Still, given the

notable negative influence of faultlines, effective faultline management through either detection and prevention or tailored intervention aimed at reversing effects is crucial. The current study can contribute to such efforts by providing an exemplar for how to detect potential faultlines without explicitly asking whether participants perceive them and determine their impact on team outcomes.

Chapter 3 - Biosafety and High Reliability Organizations

Biosafety levels (BSLs) are outlined by the Center for Disease Control (CDC) as high-containment facilities where safety is essential. Currently, there are four levels, each of which builds upon the last and has its own set of containment controls meant to safeguard workers and the surrounding community (Ta et al., 2018). BSL-1 is the lowest risk level, involving agents that do not consistently cause disease in healthy adults and pose minimal risk (Ta et al., 2018). In contrast, BSL-4 labs are the highest level of containment and are very rare. These facilities are usually physically isolated and involve work with agents that are dangerous, exotic, and pose high risk of contamination to healthy adults (Ta et al., 2018). BSL-4 labs are generally reserved for pathogens with no effective treatment or vaccines (Le Duc, 2020), and laboratory personnel must strictly adhere to many safety standards. Consequently, ensuring a high level of operation and safety is essential to these facilities to mitigate risk.

Biosafety facilities may also operate as High Reliability Organizations (HROs). Although they function in hazardous conditions, HROs rarely experience adverse events due to a high commitment to safety (Sutcliffe, 2011). Biosafety facilities must work to achieve status as an HRO; though their goals are in alignment, HRO status requires significant efforts in risk reduction. Failures within HROs would be detrimental to surrounding areas, which may

sometimes have larger societal effects (Roberts, 1990). They therefore may be willing to absorb auxiliary costs associated with reducing risk to avoid catastrophe (Roberts, 1990).

HROs operate under five basic principles. The first principle is sensitivity to operations, followed by reluctance to simplify, preoccupation with failure, deference to expertise, and practicing resilience (Veazie et al., 2019). These principles ensure that organizations are aware of complex work and systems, accept that failures and near misses are learning opportunities, defer to those with safety knowledge, and prioritize emergency training (Veazie et al., 2019). Generally, organizations with HRO status focus on developing leaders, supporting safety culture, providing training, using interventions to address safety issues, and implementing tracking systems (Veazie et al., 2019).

Unmanaged faultlines pose a significant risk to HRO and biosafety facilities in that misalignment in factors such as organizational learning, leadership, individual differences, and perceptions of the organization can lead to tensions that impair the reliability and safety of HROs (Lau & Murnighan, 1998; Offstein et al., 2014). Faultlines may be especially detrimental in high-risk organizations because of their inherent promotion of inter-team conflict and communication issues (Lau & Murnighan, 1998). Therefore, identifying alignments with the potential to lead to subgroup formation, may be useful for risk prevention in facilities where safety is paramount (Offstein et al., 2014).

HROs and biosafety facilities have little margin for safety error. Identifying potential risk factors in these facilities is highly important to ensuring continued safe operations, especially considering their commitment to a preoccupation with failure. According to James Reason's Theory of Active and Latent Failures (Reason, 2000), two types of failure contribute to errors. Active failures include unsafe acts and generally are more obvious critical incidents leading to

error, while latent failures refer to unsafe conditions that may be undetected in a system (Reason, 2000). These latent failures pose a threat to safety by creating vulnerabilities in larger systems (Reason, 2000). Faultlines may serve as either active or latent failures depending on the type, because they can influence team behaviors. Faultlines primarily negatively impact team outcomes, but they can also have downstream effects on organizational members, clients, or community members, especially in the context of biosafety and HROs. For example (though not necessarily in a biosafety context), strong faultlines in hospital teams can have negative effects on patient safety outcomes, stemming from compromised communication (Li et al., 2023). In settings where safety is crucial, communication cannot be compromised.

Faultlines pose a danger to high risk, complicated facilities, especially since the faultline activation process is unknown (Thatcher et al., 2024; Thatcher & Patel, 2012). Though faultlines must generally be active to produce differences in performance and satisfaction, dormant faultlines can still increase conflict (Thatcher et al., 2024). Additionally, dormant faultlines serve as latent failures in complex systems because they have the potential to become active. Therefore, identifying potential dormant faultlines in these facilities would be beneficial because they may become active at any point and for reasons not well understood (Lau & Murnighan, 1998; Pearsall et al., 2008; Thatcher et al., 2024), leading to human errors. Facilities working to achieve HRO status should devote attention to identifying and preventing negative effects of faultlines since they ideally have a preoccupation with failure. Though this may serve as a useful practice for organizations, little research has been devoted to faultlines in high-risk settings such as biosafety facilities, which may be working towards an HRO status.

Chapter 4 - Potential Non-Demographic Faultlines in Bio-Safety

Facilities

The following chapter outlines potential non-demographic faultlines in bio-safety facilities. Though LPA can provide a practical tool for identifying faultlines in organizations without prior knowledge, to ensure empirical rigor, the current study postulates potential faultlines a priori. Psychological safety, Leader-Member Exchange, Trust in Leaders, and Organizational Justice are discussed as non-demographic faultlines that could undermine safety, especially in bio-safety organizations, since they exist under an umbrella construct; these variables have been identified as either potential faultlines or actual antecedents of safety outcomes in prior research. Therefore, they may serve as faultlines in bio-safety facilities because differences in perceptions of these variables could lead to groups with distinct configural patterns, influencing organizational outcomes.

Psychological Safety

Faultlines have been shown to influence team-level outcomes, even though they represent differences in alignments on an individual level. In the context of high-risk facilities, an individual level variable that may influence a team outcome is psychological safety (PS), which is important to safety climate perceptions (Edmondson, 1999). Psychological safety is the shared belief that it is safe to take interpersonal risks on a team (Edmondson, 1999). Psychological safety may impact safety climate perceptions and is critical especially in organizations where safety is paramount (Newman et al., 2017; Sargent et al., 2025). In terms of faultlines, teams with perceived ingroup members (versus outgroup members) should have higher psychological safety because they are perceived as safer for interpersonal risk taking (Spoelma & Ellis, 2017). Additionally, psychological safety can explain the relationship between perceived faultlines and

training efficacy; teams with less psychological safety and perceived faultlines may have reduced training transfer (Creon & Schermuly, 2019). Psychological safety faultlines, or differences in perceptions of psychological safety within a team, may influence safety climate perceptions; research has suggested that aggregation at the organizational level may be an appropriate measure of psychological safety, but this requires alignment in perceptions (Newman et al., 2017). If such alignment does not exist, aggregation at the organizational, or indeed team-level, may not be an appropriate measurement approach (Beus et al., 2012).

Leader-Member Exchange

Leader-member exchange (LMX) refers to the quality of relationship between supervisors and their employees (Liden et al., 1993). According to LMX theory, relationships are based on leader-member social exchanges, which can differentiate across individuals; some exchanges may be high quality, and some may be low (Liden et al., 1993; Navarro, 2024). High LMX quality is characterized by a mutually beneficial and supportive relationship, which can increase trust, satisfaction, performance, and organizational citizenship behaviors (Liden et al., 1993; Martin et al., 2015). Though research has progressed to an LMX continuum rather than focusing on in-groups and out-groups based on differentiation (Navarro, 2024), such groups are still relevant to LMX faultlines because they are easily perceivable. However, it is also possible for multiple faultlines to form based on a continuum of LMX quality, if there is alignment in perception of the differences (Bruning et al., 2022; Li & Lao, 2014; Yu et al., 2018).

Because LMX can differ within groups, leaders can serve as a source of faultlines (Bruning et al., 2022), as LMX differences may lead to differential treatment, which can increase group conflict and negatively impact group processes (Chrobot-Mason et al., 2009; Yu et al., 2018). Importantly, LMX faultlines form based on shared perceptions of bimodal LMX

differentiation, which occurs when groups perceive subgroups with varying LMX quality (Li & Lao, 2014). These faultlines may become stronger with increased treatment differentiation and are influenced by justice perceptions (Badura, 2019; Bruning et al., 2022), and if they become activated LMX faultlines can lead to increased absenteeism and decreased communication quality leading to performance decrements for those in the less favored subgroup (Li & Lao, 2014; Moser et al., 2023).

Trust in Leaders

Though a foundational mechanism enabling and sustaining high-quality LMX, trust in leaders has received less empirical attention (Podsakoff et al., 1990). Trust in leaders (TIL) refers to employees' loyalty towards and faith in their leaders' intentions. Effective leaders earn follower trust, and this plays a critical role in transformational leadership; leaders who are both trusted and respected tend to perform better than those who aren't (Podsakoff et al., 1990).

Trust is essential in high-risk contexts, and though its role is not entirely understood, trust may be essential to determining employees' safety perceptions and attitudes and is a dynamic concept; several types of trust exist depending on context (Conchie et al., 2016). Trust in leaders is specifically important to developing and facilitating safety behaviors (Conchie et al., 2006; Lee et al., 2021). Leaders who foster trust with subordinates are more likely to create a safe working environment and greater psychological safety (Luria, 2010). Trust is negatively related to injury and positively related to safety climate (Luria, 2010). Therefore, though trust in leaders has not previously been examined as a potential faultline in safety research, differences in trust in leaders within groups could serve as such. In fact, increased trust has been shown to decrease conflict associated with faultlines (Peñarroja et al., 2024). Therefore, the current study will examine trust in leaders as a potential faultline.

Organizational Justice

Justice perceptions are important to organizational behavior (Folger & Cropanzano, 1998); differences in perceptions of justice climate might explain behavioral differences. Organizational justice (OJ) perceptions have been examined in the context of organizational faultlines, specifically in relation to conflict, since the two are theoretically linked (Folger & Cropanzano, 1998). They have also been consistently applied to understanding LMX differentiation because LMX variation can negatively affect justice perceptions (Martin et al., 2018), meaning that justice perceptions may lead to differences in alignments within teams. In fact, much research considers justice a boundary condition of faultline-outcome relationships, or vice-versa (e.g., Badura, 2019; Bezrukova et al., 2010; Spell et al., 2011). Justice perceptions have been established as an antecedent of intragroup conflict (Jehn, 1995), especially task conflict (Spell et al., 2011). Interestingly, the existence of faultlines may moderate negative outcomes of reduced interactional justice because it can provide a coping mechanism for those facing poor justice climate (Bezrukova et al., 2010). However, some research suggests that activated faultlines threaten justice climate, increasing conflict and decreasing performance (Antino et al., 2019). The relationship between justice, faultlines, and conflict is a bit murky, but faultline research suggests that justice climate does seem to be an important factor to consider when investigating faultline outcomes and/ or formation.

Chapter 5 - Hypotheses

The current study aims to adopt a novel approach to explore and measure faultlines in a high-risk setting. One limitation of faultline research is that it has inspired diverse measurement methods and lacks a common measurement method, or a method that is consistently used above others, and it lacks a useful tool for organizations. Faultline research's reliability could be

improved with a common measurement; comparing and identifying the most appropriate measure would help advance the area (Thatcher & Patel, 2012). Therefore, the current study aims to address this limitation by focusing on latent profile analysis (LPA). LPA may identify faultlines that are latent and imperceivable, since it can detect profiles without explicit prior identification (Srouf & Karkoulou, 2022). Faultlines can impact safety priorities by splitting teams or organizations into subgroups with decreased communication and performance quality. Therefore, especially in the context of HROs and biosafety facilities, identification of dormant, unperceived faultlines could be important to mitigating conflict and ensuring smooth safety operations. This approach may be especially useful when no concerns have been raised, but organizational data is readily available. However, few studies have attempted to adopt methodologically rigorous and generalizable techniques for identifying dormant faultlines (e.g., Lawrence & Zyphur, 2011; Mayo et al., 2016; Srouf & Karkoulou, 2022). Therefore, the current study aims to adapt LPA in the context of organizations where safety is paramount, specifically within a biosafety facility. Based on prior research summarized in literature review, study one aims to address the following hypotheses, based on an overarching research question.

RQ: How will subgroups emerge based on configural alignment in ratings of psychological safety, LMX, trust in leaders, and organizational justice?

It is expected that profiles identified in LPA will demonstrate statistically significant differences in team variables and organizational safety climate, confirming distinct latent subgroups (H1). Among the identified profiles, within-group agreement and between group-distinctions will be supported by $r_{wg(j)}$ and ICC1/2 relating to PS, LMX, TIL, and OJ, further confirming the treatment of latent subgroups (H2). The effects of faultlines on measurement cannot be overlooked; in line with prior research indicating that faultlines may result in

measurement inequivalence, profiles may influence measurement invariance of outcome variables (safety climate, team efficacy, and team communication quality), such that invariance is not achieved across profiles (H3). In line with the main tenets of faultline theory regarding effects on team qualities (including communication and efficacy) and organizational climate profiles, members' perceptions of safety climate and team qualities will significantly differ such that profiles with higher alignment will have higher scores (H4).

Chapter 6 - Methods

Participants

Participants were recruited from a large, midwestern biosafety organization where operational safety is critical. I distributed a Qualtrics link for a survey via email to top management, who forwarded the email to all employees' organizational emails, announced it at a bi-weekly facility wide meeting, and periodically sent reminder emails to encourage the employees to take the survey. Participation was completely voluntary, and participants did not receive compensation for their contributions, but executive leadership strongly encouraged participation. Employees were allowed to remain completely anonymous, as the survey was completed in part to inform later programming for the facility. As such, disclosing detailed demographic information (e.g., unit, age, tenure, gender, and pay grade) was voluntary.

A total of 246 participants accessed the survey, but only 185 participants completed it, for a response rate of 75.20%. Participants with incomplete data for the variables of interest and who had completed less than 97% of the survey were removed, resulting in 145 participants for the final sample. Of participants who voluntarily disclosed their age ($n=106$), the average age was 42.96 ($sd = 10.85$). Of those who disclosed their gender ($n=132$), 44.70% were men, 39.40% were women, 14.40% preferred not to say, and 1.52% were non-binary.

Measures

Psychological safety was measured with Edmondson's (1999) seven-item Psychological Safety Scale. Items were rated on a Likert-type scale, ranging from 1 (*Never*) to 5 (*Always*). An example item is "*If you make a mistake on this team, it is often held against you.*" Higher scores indicate higher psychological safety.

Leader member exchange was measured with Graen and Uhl-Bien's (1995) seven-item Leader-member Exchange scale. Items were rated on a five-point Likert-type scale, and rating anchors changed with statements. For example, "*How well does your leader recognize your potential?*" was rated from 1 (Not at all) to 5 (Fully), while "*How would you characterize your working relationship with your leader?*" was rated from 1 (Extremely ineffective) to 5 (Extremely effective). Higher scores indicate higher LMX quality.

Trust in leaders was measured with Podsakoff's (1990) six-item Trust in Leaders Scale. Items were rated on a Likert-type scale, ranging from 1 (*Not at all*) to 5 (*Very much*). An example item is "*I feel quite confident that my leader will always try to treat me fairly.*" Higher scores indicate greater trust in leaders.

Organizational justice was measured with sixteen items from Colquitt's (2001) Organizational Justice scale, including only procedural, informational, and interpersonal subscales. Items were slightly adapted to appeal to employees in the context of a high-risk facility, focusing specifically on safety procedures. Items were rated on a Likert-type scale, ranging from 1 (*To a small extent*) to 5 (*To a large extent*). An example item is "*Have you been able to express your views and feelings during [safety] procedures?*" Higher scores indicate higher perceived organizational justice levels.

Organizational Safety climate was measured with four items from Huang et al.'s (2017) short safety climate scales. Items were rated on a Likert-type scale, ranging from 1 (*Never*) to 5 (*Always*). An example item is “*Top management at this company tries to continually improve safety levels in each department.*” Higher scores indicate stronger safety climate.

Team efficacy was measured with Edmondson's (1999) three-item scale. Items were rated on a Likert-type scale, ranging from 1 (*Never*) to 5 (*Always*). An example item is “*Achieving this team's goals is well within our reach.*” Higher scores indicate greater team efficacy.

Team communication quality was measured with five items from Gonzalez-Roma and Hernandez's (2014) Team Communication Quality scale. Items were rated on a Likert-type scale, ranging from 1 (*Not at all*) to 5 (*Very much*). An example item is “*To what extent is communication among members of your team... fluid.*” Higher scores indicate greater team communication quality.

Counterfactual Sharing (included in supplementary analyses) was measured with five items from He et al. (2022). Items were rated on a Likert-type scale, ranging from 1 (*Never*) to 5 (*Always*). An example item is “*We discuss what could have been done to change negative outcomes.*” Higher scores indicate higher perceptions of counterfactual sharing among employees.

Error Disclosure (included in supplementary analyses) was measured with ten items from Etchegaray et al. (2012) and He et al. (2022), adapted to fit a biosafety context. Items were rated on a Likert-type scale, ranging from 1 (*Never*) to 5 (*Always*). An example item is “*We routinely disclose minor biohazard incidents to members in my team/unit.*” Higher scores indicate higher perceptions of error disclosure among employees.

Analyses

Analyses were conducted in R version 4.5.2. Prior to analysis, all study measures were assessed with confirmatory factor analysis (CFA) to assess goodness of fit, especially given the implications that faultlines carry for measurement invariance. The *lavaan* package (Rosseel et al., 2025) and *semTools* package (Jorgensen et al., 2025) were used to conduct CFA and assess convergent and discriminant validity. The comparative fit index (CFI), the, the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR) were used to assess fit according to the recommended, acceptable thresholds from Hu and Bentler (1999): $CFI \geq .90$ and $RMSEA$ and $SRMR \leq .08$. Considering the small sample size in the current study, SRMR may be more reliable than RMSEA (Chen et al., 2008; Kenny et al., 2014). Therefore, when RMSEA did not indicate satisfactory fit, SRMR was used as the default to evaluate overall goodness of fit of the measurement model. Team-oriented variables (team communication quality and effectiveness) were combined for this analysis to assure model convergence, since they were conceptually related and each scale only had three items. Additionally, the discriminant validity of team efficacy and team communication quality were examined since the two may have had some conceptual overlap to participants, especially given that both constructs were concerned about their units/teams. Convergent and discriminant validity of team variables was assessed with a two-factor CFA to support scale combination. An average variance explained, or $AVE > 0.50$ indicates convergent validity (Fornell & Larcker, 1981). Discriminant validity was examined with the hetero-trait mono-trait (HTMT) ratio of correlations (Henseler et al., 2015), where values < 0.85 indicate discriminant validity (Kline, 2011).

To address the main research question, data was analyzed with latent profile analysis (LPA), using the *mclust* package (Scrucca et al., 2023), *factoextra* package (Kassambra, 2020) for visualization, and *tidyLPA* package (Rosenberg et al., 2018) to calculate classification accuracy. Latent profile analysis is a clustering technique that focuses on patterns of variables to create a categorical latent variable (Spurk et al., 2020). LPA can identify subpopulations resulting from configural alignments within a given population based on given sets of variables, which may be useful for faultline identification; it assumes heterogeneity within a population that can lead to distinct profiles. Thus, it adopts a person-centric analytic approach, which is underused in organizational research despite its potential in facilitating understanding of relationships within organizations (Woo et al., 2018). LPA has applications in addressing specific research questions and exploratory research (Spurk et al., 2020). LPA provides utility in that identified latent profiles can be analyzed with any multi-group analytic technique to compare profile differences (Spurk et al., 2020).

For this study, there is no a priori faultline identification, but there is an expectation of subgroup patterns based on prior research (see hypotheses). As such, LPA was conducted to test hypotheses one, two, and four, identifying whether specific patterns of alignment lead to meaningful clusters. The auto-generated model and two alternative models were assessed for best fit, including a model with one fewer profile, in line with best practices for LPA (Spurk et al., 2020). The final number of profiles was determined based on comparisons of alternative models using the log-likelihood, Bayesian Information Criterion (BIC), and entropy statistics. These indicate the relative fit of the model compared to others and the overall ability of the model to create well-separated profiles (or confidence in group membership), respectively (Spurk et al., 2020). Models with lower BIC values indicate best fit, as do those with log-

likelihood values closer to zero (Berlin et al., 2014; Spurk et al., 2020). Entropy values closer to one, ideally $>.80$ (Clark & Muthén, 2009), indicate good model fit. For H2, LPA-derived profiles were treated as nested clusters to examine emergence properties. After profile identification, ANOVAs and subsequent Tukey's HSD tests were conducted to determine whether organizational outcomes such as safety climate, team efficacy, and team communication quality differed significantly across the identified profiles.

Within group agreement and between group variations were with assessed with Intraclass correlation coefficients (ICCs) one and two and within group agreement ($r_{wg(j)}$), which were examined using the multilevel (Bliese, 2025) and psych packages (Revelle, 2019), respectively to support hidden group treatments and determine group alignment level. ICCs 1 and 2 represent the amount of variance in an individual response that can be explained by group membership, and the reliability of the group mean, respectively (Bliese, 2000). Within group agreement ($r_{wg(j)}$) indicates the degree to which individual ratings are interchangeable, or whether any given group member's response is identical to another's (Bliese, 2000). For the current study, these indicate whether there are shared perceptions within groups regarding PS, LMX, TIL, and OJ and whether there is meaningful between-groups variation in the outcome variables (safety climate, team efficacy, and team communication quality); they denote faultline strength. Levels of ICC1 $\geq .20$ (Bliese, 2000; LeBreton & Senter, 2008) and ICC 2 > 0.75 indicate that variance in individual responses can be explained by group membership and that the group mean is reliable (Nunnally & Bernstein, 1994). An $r_{wg(j)} > .70$ indicates high within group agreement (Lance et al., 2006).

Multi-group CFA (confirmatory factor analysis) was conducted to test hypothesis three, with emphasis placed on the configural level, to examine whether profiles influenced

measurement invariance. Configural invariance indicates that observed measures represent the same underlying construct between groups; if configural variance is not met, observed values represent different underlying constructs (Vandenberg & Lance, 2000). Invariance was evaluated according to change in CFI with $\Delta CFI \leq .01$ and overlap between RMSEA confidence intervals, indicating that invariance holds (Cheung & Rensvold, 2002; Wang & Russell, 2005).

Chapter 7 - Results

Descriptive statistics, item correlations, and Cronbach's alphas are presented in Table 1. Most variables had moderate mean scores, considering their 1-5 scale. Psychological safety had a mean score of 3.56 ($sd = .73$), organizational justice had a mean score of 3.73 ($sd = 0.95$), leader member exchange had a mean score of 3.63 ($sd = 0.97$), and trust in leaders had a score of 3.99 ($sd = 0.95$). Regarding outcome variables, team efficacy and communication had a mean score of 3.84 ($sd = 0.94$), and 3.60 ($sd = 1.04$), respectively. Safety climate had a mean score of 3.87 ($sd = 1.04$).

Table 1. Descriptive Statistics, Correlations, and Alphas

	<i>m</i>	<i>sd</i>	1	2	3	4	5	6	7
1. Psychological Safety	3.56	0.73	0.70						
2. Organizational Justice	3.73	0.95	0.54	0.81					
3. Leader-Member Exchange	3.63	0.97	0.57	0.80	0.91				
4. Trust in Leaders	3.99	0.95	0.52	0.75	0.83	0.86			
5. Team Efficacy	3.84	0.94	0.41	0.36	0.32	0.19	0.84		
6. Team Communication	3.60	1.04	0.54	0.54	0.49	0.41	0.51	0.95	
7. Safety Climate	3.87	1.04	0.54	0.70	0.69	0.58	0.42	0.35	0.94

Note. Cronbach's alphas are presented on the diagonal.

Confirmatory Factor Analysis (CFA) was conducted for all study variables to confirm appropriate model fit before conducting further analyses. Maximum likelihood ratio was used as the model estimator to account for non-normal data and small sample size. As such, robust estimates for CFI, RMSEA, and SRMR are reported below. Additionally, team indicators

(communication quality and efficacy) were combined for CFA, as they each had fewer than three items. The AVE for team efficacy was 0.65 and for team communication it was 0.83, demonstrating convergent validity, and the HTMT ratio between team efficacy and communication was 0.54, indicating discriminant validity. Thus, it is appropriate to combine the scales for CFA, but they still measure distinct constructs, warranting differential treatment as outcome variables.

CFA results (presented in Table 2) indicate appropriate fit to the data for all study variables. Psychological safety demonstrated acceptable fit as a whole; poor fit according to robust RMSEA, acceptable fit according to robust CFI, and good fit according to robust SRMR ($\chi^2 = 38.19$ (14), $p < .001$, robust CFI = .88, robust RMSEA = .11, robust SRMR = .07). Though there was suboptimal fit in CFI and RMSEA, CFI is approaching the cutoff, and the more reliable index, SRMR, is $< .08$. Organizational justice demonstrated good fit ($\chi^2 = 165.30$ (101), $p < .001$, robust CFI = .97, robust RMSEA = .07, robust SRMR = .05). Leader-member Exchange demonstrated good fit, except for RMSEA ($\chi^2 = 43.98$ (14), $p < .001$, robust CFI = .94, robust RMSEA = .14, robust SRMR = .05), as did Trust in Leaders ($\chi^2 = 45.65$ (9), $p < .001$, robust CFI = .93, robust RMSEA = .17, robust SRMR = .05). Safety Climate demonstrated excellent fit ($\chi^2 = 0.93$ (2), $p = .629$, robust CFI = 1.00, robust RMSEA = .00, robust SRMR = .01), as did team indicators ($\chi^2 = 6.79$ (8), $p = .559$, robust CFI = 1.00, robust RMSEA = .00, robust SRMR = .02).

Table 2. Results of CFA Testing for Study Variables

Model	Scaled χ^2	df	p	Scaling Correction Factor	Robust CFI	Robust RMSEA	95% CI (RMSEA)		SRMR
							Lower	Upper	
Psychological Safety	38.19	14	0.000	1.05	0.88	0.11	0.07	0.16	0.07
Organizational Justice	165.30	101	0.000	1.20	0.97	0.07	0.05	0.09	0.05

Leader-Member Exchange	43.98	14	0.000	1.27	0.94	0.14	0.09	0.18	0.05
Trust In Leaders	45.65	9	0.000	1.08	0.93	0.17	0.13	0.23	0.05
Safety Climate	0.93	2	0.629	2.28	1.00	0.00	0.00	0.20	0.01
Team Indicators	6.79	8	0.559	1.31	1.00	0.00	0.00	1.00	0.02

Note. Cutoffs were based on Hu and Bentler's (1999). Bolded values indicate robust CFI $\geq .90$

and RMSEA and SRMR $\leq .08$. Maximum Likelihood Ratio estimation was used.

Hypothesis Testing

To address the research question (How will subgroups emerge based on configural alignment in ratings of psychological safety, LMX, trust in leaders, and organizational justice?), LPA, ANOVA, and Tukey's HSD tests were conducted and ICCs 1 and 2 and $r_{wg(j)}$ were calculated to test hypotheses one through four.

LPA was conducted to test hypothesis one. Results of LPA with psychological safety, LMX, trust in leaders, and organizational justice initially generated a four-profile model. However, in line Spurk et al.'s (2020) best practices for assessing LPA model fit, a three-profile and five-profile model were also fit for comparison, to ensure that the best-fitting model was used for hypothesis testing. Output for these models is presented in Table 3, and figures for visualizing profile separation and patterns are in Appendix 1. Though a model with four profiles was generated by default, a model with three profiles had only slight decrements in BIC ($\Delta\text{BIC} = 3.91$) and higher entropy (.92). Considering the model fit statistics, parsimony, and interpretability, the three-profile model was chosen for hypothesis testing in subsequent analyses due to higher classification accuracy (see Appendix 1 for visual comparisons of each model). A visualization of the three-cluster model is presented in Figure 4, representing the profiles' separability.

Table 3. Comparison of LPA Models

Model	Log-likelihood	N	df	BIC	Entropy	Profile Size (n)				
						Profile 1	Profile 2	Profile 3	Profile 4	Profile 5
3-profile	-514.39	145	26	-1,158.81	0.92	22	72	51	-	-
4-profile	-512.75	145	26	-1,154.90	0.85	19	48	37	41	-
5-profile	-505.36	145	32	-1,169.98	0.85	19	48	11	34	33

Note. Models with lower BIC values indicate best fit, as do log-likelihood values closer to zero

(Berlin et al., 2014; Spurk et al., 2020). Entropy values closer to one indicate better fit (Clark & Muthén, 2009).

Figure 4. LPA Model with Three Profiles

Note. The size of each profile is as follows: Profile one ($n = 22$), profile two ($n = 72$), and profile three ($n = 51$).

Following model selection, within group agreement ($r_{wg(j)}$) and interclass correlation coefficients one and two were calculated to determine profile alignment and distinction. To test hypothesis two, within-group agreement ($r_{wg(j)}$) and ICCs 1 and 2 were calculated for each variable, PS, OJ, TIL, and LMX across profiles (see Table 4). Regarding within-group agreement for specific variables, psychological safety had the highest $r_{wg(j)}$ in profile three ($r_{wg(j)} = .91$), followed by profile one ($r_{wg(j)} = .89$), and then profile two ($r_{wg(j)} = .84$). Trust in leaders had a similar pattern; $r_{wg(j)}$ was highest in profile three ($r_{wg(j)} = .96$), followed by profile one ($r_{wg(j)} = 0.90$), and then profile two ($r_{wg(j)} = .89$). Organizational justice had the highest within-group agreement in profile three ($r_{wg(j)} = .99$), and profiles one and two had the same within-group agreement ($r_{wg(j)} = .94$). For LMX, profile three had the highest within-group agreement ($r_{wg(j)} = .97$), followed by profile two ($r_{wg(j)} = .94$), and finally profile one ($r_{wg(j)} = .92$). ICCs one and two are strong for all faultline variables (see Table 4), further indicating distinct groups. The amount of variance in an individual response (ICC1) was satisfactory for psychological safety (ICC1 = .50), organizational justice (ICC 1 = .78), trust in leaders (ICC 1 = .77), and LMX (ICC 1 = .84). The reliability of the group mean (ICC 2) was also strong for psychological safety (ICC 2 = .98), organizational justice (ICC 2 = .99), trust in leaders (ICC 2 = .99), and LMX (ICC 2 = 1.00). Therefore, hypothesis two is supported; within-group agreement and between-group distinctions are supported by $r_{wg(j)}$ and ICCs one and two. Members within each profile respond similarly on the variables used to define the profiles, making the profiles internally homogeneous and meaningfully defined, as the grouping reflects shared perceptions, attitudes, or experiences rather than being arbitrary.

Table 4. Faultline Means, Standard Deviations, Within-group Agreement, and ICCs

Variable	ICC 1	ICC 2	Profile 1 ($n=22$)			Profile 2 ($n=72$)			Profile 3 ($n=51$)		
			Mean	sd	$r_{wg(j)}$	Mean	sd	$r_{wg(j)}$	Mean	sd	$r_{wg(j)}$

Psychological Safety	0.50	0.98	2.92	0.54	0.89	3.33	0.66	0.84	4.17	0.41	0.91
Organizational Justice	0.78	0.99	2.08	0.63	0.94	3.68	0.58	0.94	4.52	0.35	0.98
Trust in Leaders	0.77	0.99	2.32	0.41	0.90	3.97	0.67	0.89	4.74	0.31	0.96
Leader Member Exchange	0.84	1.00	2.03	0.53	0.92	3.44	0.53	0.94	4.59	0.30	0.97

Visualizations of the profile scores were also generated to examine alignment, or the within-group agreement of the profiles (see Appendix 1). Based on ICCs 1 and 2, $r_{wg(j)}$, and profile visualizations, one high-alignment profile and two lower alignment profiles exist within the organization, though all profiles had good alignment (see Table 4 for means and standard deviations, ICCs 1 and 2, and $r_{wg(j)}$ and Appendix 1 for visualizations). This indicates three subgroups based on strong faultlines in psychological safety, trust in leaders, leader member exchange, and organizational justice, supporting hypothesis two. Profile three falls in the highest scoring range for psychological safety, organizational justice, trust in leaders, and LMX, and is most aligned. Profiles one and two are not as well-aligned, and profile two scores in the median for psychological safety, organizational justice, trust in leaders, and LMX. Profile one scores in the lower range for the same variables. In the context of the current study, profile three is determined to be a high-alignment profile, and profiles one and two are lower-alignment profiles.

As an additional gauge of profile alignment, ICCs one and two and $r_{wg(j)}$ were also computed to determine how much profiles aligned based on the outcome variables (safety climate and team indicators, see Table 5). The amount of variance in an individual response (ICC1) attributable to group membership was satisfactory for safety climate (ICC1 = .32), team efficacy (ICC1 = .24), and team communication quality (ICC1 = .35), as was the reliability of the group mean (ICC 2) for safety climate (ICC 2 = .96), team efficacy (ICC 2 = .95), and (ICC 2

= .96), indicating that group means are reliable and variance for outcome variables can be attributed to group membership. Within-group agreement for safety climate was highest for profile three ($r_{wg(j)} = .94$), and equal across profiles one and two ($r_{wg(j)} = .73$). For team efficacy, within-group agreement was highest for profile three ($r_{wg(j)} = .94$), followed by profile two ($r_{wg(j)} = .83$), and profile one ($r_{wg(j)} = .77$). This pattern held true for team communication quality; , within-group agreement was highest for profile three ($r_{wg(j)} = .95$), followed by profile two ($r_{wg(j)} = .86$), and profile one ($r_{wg(j)} = .82$). Despite slight difference in within-group agreement for outcome variables, the identified three profiles have high within group agreement and between group differences. This demonstrates that profiles are coherent in terms of safety climate, team efficacy, and team communication effectiveness, further supporting hidden group treatment.

Table 5. Outcome Means, Standard Deviations, Within-group Agreement, and ICCs

Variable	ICC1	ICC2	Profile 1 ($n=22$)			Profile 2 ($n=72$)			Profile 3 ($n=51$)		
			Mean	sd	$r_{wg(j)}$	Mean	sd	$r_{wg(j)}$	Mean	sd	$r_{wg(j)}$
Safety Climate	0.32	0.96	2.43	0.84	0.73	3.81	0.86	0.73	4.59	0.57	0.94
Team Efficacy	0.24	0.94	3.58	1.00	0.77	3.53	0.94	0.83	3.36	0.62	0.94
Team Communication Quality	0.35	0.96	2.77	1.07	0.82	3.36	0.97	0.86	4.29	0.68	0.95

Multigroup CFAs were conducted to test hypothesis three (see Table 6), specifically focused on configural invariance. Results indicate that safety climate had weak configural invariance according to change in CFI ($\Delta CFI = -.04$) and overlapping RMSEA confidence intervals. Metric and scalar invariance were tested as well, but weak configural invariance indicates lack of invariance overall for safety climate. In contrast, team indicators had strong invariance. They met configural invariance according to both change in CFI ($\Delta CFI = 0$) and overlap of RMSEA confidence intervals, metric invariance according to change in CFI ($\Delta CFI = -.008$) and overlap of RMSEA confidence intervals, and scalar invariance according to change in

CFI ($\Delta\text{CFI} = .008$) and overlap of RMSEA confidence intervals. Therefore, hypothesis three is partially supported; faultlines influence measurement invariance for team indicators, but not safety climate. While the LPA-identified latent faultlines (profiles) showed meaningful differences in the focal variables, the measurement model demonstrated invariance across profiles for team qualities, and group-level agreement was high (ICCs and $r_{\text{wg}(j)}$), indicating that the perceptions underlying these measures are comparable across profiles and that observed differences may be substantive rather than measurement-driven, especially for measures aggregated at the team level. However, perceptions underlying measures aggregated at the organizational level (in this case, safety climate) may be influenced by faultlines.

Table 6. Results of Multigroup CFA testing Measurement Invariance

Model	Scaled χ^2 ($\Delta \chi^2$)	df (Δdf)	p (Δp)	Robust CFI (ΔCFI)	Robus t RMSE A	95% CI (RMSEA)	
						Lower	Upper
Safety Climate	0.93	2	0.629	1.00	0.00	0.00	0.20
Step 1: Configural	(15.11)	(4)	(-0.615)	(-0.038)	0.23	0.10	0.37
Step 2: Metric	(6.20)	(6)	(0.021)	(0.002)	0.16	0.04	0.26
Step 3: Scalar	(12.35)	(6)	(-0.024)	(-0.017)	0.16	0.07	0.24
Team Indicators	6.79	8	0.559	1.00	0.00	0.00	1.00
Step 1: Configural	(12.22)	(16)	(0.192)	(0.00)	0.00	0.00	0.09
Step 2: Metric	(16.77)	(16)	(-0.456)	(-0.008)	0.05	0.00	0.12
Step 3: Scalar	(3.62)	(13)	(0.202)	(0.008)	0.00	0.00	0.10

Note. Invariance was evaluated according to change in CFI with $\Delta\text{CFI} \leq .01$ and overlap

between RMSEA confidence intervals, indicating that invariance holds (Cheung & Rensvold, 2002; Wang & Russell, 2005). Boldface indicates invariance holds.

After determining profile alignment and establishing measurement invariance, ANOVA and Tukey's HSD tests were conducted to examine whether the potential organizational outcomes like safety climate, team effectiveness, and team communication are significantly different across the three identified profiles, testing hypotheses one and four.

Results of a one-way ANOVA predicting safety climate, team communication, and team efficacy across profiles (see Table 7) demonstrated a statistically significant difference in safety climate between profiles ($F(2,142) = 23.39, p < .001$). Therefore, Tukey's HSD tests were conducted to examine where profiles differed. Results (presented in Table 8) revealed a significant difference in safety climate between profiles one and two ($p = .002, 95\% \text{ CI} = [.273, 1.435]$), profiles one and three ($p < .001, 95\% \text{ CI} = [1.077, 2.293]$), and profiles two and three ($p = .000, 95\% \text{ CI} = [.394, 1.267]$), with profile three having the highest safety climate. Results of a one-way ANOVA showed that there was a statistically significant difference in team efficacy between profiles ($F(2,142) = 16.44, p < .001$). Tukey's HSD testing revealed a significant difference in team efficacy between profiles one and three ($p = .001, 95\% \text{ CI} = [.296, 1.323]$), and profiles two and three ($p = .000, 95\% \text{ CI} = [.490, 1.226]$), with profile three having the highest team efficacy. Finally, results of a one-way ANOVA showed that the difference in team communication quality was also statistically significant between profiles ($F(2,142) = 26.82, p < .001$). Tukey's HSD testing revealed a significant difference in team communication quality between profiles one and two ($p = .021, 95\% \text{ CI} = [.074, 1.108]$), profiles one and three ($p = .000, 95\% \text{ CI} = [.972, 2.055]$), and profiles two and three ($p = .000, 95\% \text{ CI} = [.534, 1.311]$), with profile three having the highest team communication quality. Results of ANOVA and provide support for hypothesis one; profiles identified in LPA demonstrate statistically significant differences in team outcomes and safety climate. Results of Tukey's HSD testing also

support hypothesis four; profiles with higher alignment had higher scores on outcome variables (though all profiles were fairly well-aligned according to $r_{wg(j)}$ and ICCs).

Table 7. Results of ANOVAs Predicting Safety Climate, Team Efficacy, and Team Communication Quality

Outcome Variable	Source	<i>df</i>	<i>F</i>	<i>p</i>
Safety Climate	Profile	2	23.39	< .001
	Residuals	142		
Team Efficacy	Profile	2	16.44	< .001
	Residuals	142		
Team Communication	Profile	2	26.82	< .001
	Residuals	142		

Table 8. Results of Tukey's HSD Tests Comparing Safety Climate, Team Efficacy, and Team Communication Across Profiles

Outcome Variable	Contrast	Mean Difference	95% Confidence Interval		<i>p</i>
			Lower	Upper	
Safety Climate	2-1	0.854	0.273	1.435	0.002
	3-1	1.685	1.077	2.293	<0.001
	3-2	0.831	0.394	1.267	<0.001
Team Efficacy	2-1	-0.048	-0.538	0.442	0.971
	3-1	0.810	0.296	1.323	0.001
	3-2	0.858	0.490	1.226	<0.001
Team Communication	2-1	0.591	0.074	1.108	0.021
	3-1	1.514	0.972	2.055	<0.001
	3-2	0.922	0.534	1.311	<0.001

Supplementary Analyses

A supplementary hypothesis was proposed after examining PS, TIL, OJ, and LMX. Though there is no research to suggest that counterfactual sharing (CFS) and error disclosure (ED) specifically may be affected by faultlines, it is possible that safety behaviors are impacted by faultlines (Bezrukova et al., 2009). If so, they may indicate active faultlines. As such, counterfactual sharing and error disclosure were examined in supplementary analyses as an

exploratory indication of whether faultlines based on safety-related constructs can impact safety behaviors. Similar to hypothesis four, across identified profiles, members' reported safety behaviors (error disclosure and counterfactual sharing) will be significantly different such that profiles with higher alignment will have higher scores in safety behaviors (H5). Supplementary analyses were conducted to test this hypothesis.

Profile alignment was determined in earlier analyses following LPA, but for a reminder the alignments are summarized as follows. Profile three falls in the highest scoring range for psychological safety, organizational justice, trust in leaders, and LMX, and is most aligned. Profile two is not as well aligned, and scores in the median for psychological safety, organizational justice, trust in leaders, and LMX. Profile one is not as well aligned, and scores in the lower range for the same variables. Therefore, profile three is a high-alignment profile, and profiles one and two are lower-alignment profiles. Again, within-group agreement, reliability of the mean, and variance attributable to group membership all indicate that profiles are coherent in terms of PS, LMX, OJ, and TIL, and distinct from other profiles.

To keep consistent with prior analyses, alignment was also determined for the outcome variables (safety behaviors), but these are not considered in hypothesis testing. As before, ICCs one and two and $r_{wg(j)}$ were computed to determine how much profiles aligned. Results (see Table 9) indicate that profiles one and three had the same profile alignment in counterfactual sharing ($r_{wg(j)} = .78$), followed by profile two ($r_{wg(j)} = .63$). For error disclosure, profile three had high alignment ($r_{wg(j)} = .93$), but profiles one and two had poor alignment ($r_{wg(j)} = .41$, and $r_{wg(j)} = .68$, respectively). Although three latent faultlines were identified and showed meaningful differences in focal variables, low $r_{wg(j)}$ values ($< .70$) for two of the profiles indicate that members' perceptions of error disclosure within these faultlines are only moderately aligned,

suggesting caution when interpreting these profiles as fully cohesive in terms of shared perceptions of behavior. ICC 1 and 2 are strong (see Table 9), indicating meaningful clusters. The amount of variance in an individual response (ICC1) attributable to group membership was satisfactory for counterfactual sharing (ICC1 = .28) and error disclosure (ICC1 = .28), as was the reliability of the group mean for counterfactual sharing (ICC 2 = .95) and error disclosure (ICC 2 = .95). This indicates that group means are reliable and variance in error disclosure and counterfactual sharing can be attributed to group membership, but within-group agreement is not consistent. Still, most identified profiles have reliable group means and variance can be explained by group membership, which means profiles are generally coherent in terms of counterfactual sharing and error disclosure culture, and distinct from others.

Table 9. Profile Means, Standard Deviations, Within-group Agreement, and ICCs

Variable	ICC1	ICC2	Profile 1 (<i>n</i> = 22)			Profile 2 (<i>n</i> = 72)			Profile 3 (<i>n</i> = 51)		
			Mean	sd	<i>r</i> _{wg(j)}	Mean	sd	<i>r</i> _{wg(j)}	Mean	sd	<i>r</i> _{wg(j)}
Counterfactual Sharing	0.28	0.95	2.29	0.96	0.78	3.35	1.27	0.63	4.13	1.11	0.78
Error Disclosure	0.28	0.95	3.30	0.01	0.41	4.02	0.88	0.68	4.56	0.54	0.93

ANOVA and subsequent Tukey's HSD testing was conducted to directly test hypothesis five. Results of a one-way ANOVA predicting counterfactual sharing and error disclosure (see Table 10) demonstrated a statistically significant difference in counterfactual sharing between profiles ($F(2,142) = 19.65, p < .001$). Tukey's HSD testing (see Table 11) revealed a significant difference in counterfactual sharing between profiles one and two ($p = .001, 95\% \text{ CI} = [0.39, 1.74]$), profiles one and three ($p < .001, 95\% \text{ CI} = [1.13, 2.55]$), and profiles two and three ($p = .001, 95\% \text{ CI} = [0.27, 1.29]$). Results of a one-way ANOVA also indicated that there was a statistically significant difference in error disclosure between profiles ($F(2,142) = 19.75, p < .001$). Tukey's HSD testing revealed a significant difference in error disclosure between

profiles one and two ($p = .001$, 95% CI = [0.26, 1.18]), profiles one and three ($p < .001$, 95% CI = [0.77, 1.74]), and profiles two and three ($p = .001$, 95% CI = [0.19, 0.88]). Overall, profile three had significantly higher counterfactual sharing and error disclosure than profiles one and two. Therefore, the supplementary hypothesis (H5) is supported; safety behaviors (error disclosure and counterfactual sharing) significantly differ across profiles such that those in higher alignment have higher scores in safety behaviors.

Table 10. Results of ANOVAs Predicting Counterfactual Sharing and Error Disclosure

Outcome Variable	Source	df	F	<i>p</i>
Counterfactual Sharing	Profile	2	19.6	< .001
	Residuals	142	5	
Error Disclosure	Profile	2	19.7	<0.001
	Residuals	142	5	

Table 11. Results of Tukey's HSD Tests Comparing Counterfactual Sharing and Error Disclosure Across Profiles

Outcome Variable	Contrast	Mean Difference	95% Confidence Interval		<i>p</i>
			Lower	Upper	
Counterfactual Sharing	2-1	1.06	0.39	1.74	0.001
	3-1	1.84	1.13	2.55	<0.001
	3-2	0.78	0.27	1.29	0.001
Error Disclosure	2-1	0.72	0.26	1.18	0.001
	3-1	1.26	0.77	1.74	<0.001
	3-2	0.54	0.19	0.88	0.001

Chapter 8 - Discussion

The current study aimed to adopt a novel approach to explore and measure faultlines in a high-risk setting to address a limitation of faultline research regarding lack of common measurement method. In this case, LPA was used to identify dormant faultlines in the context of a biosafety facility. It also aimed to address the question, how will subgroups emerge based on

configural alignment in ratings of psychological safety, LMX, trust in leaders, and organizational justice? LPA-identified subgroups emerged reflecting low, medium, and high-scoring clusters across these variables, possibly suggesting a main effect of each of these clusters. This may be an artifact of how the profiles were identified when creating the LPA model; to ensure empirical rigor these faultlines were chosen a priori, but in an organizational setting LPA can be used without a priori identification, in a more exploratory manner. Still, these preliminary results support that LPA can be useful in identifying existing or underlying subgroups that could serve to undermine overall organizational alignment and impact organizational outcomes. Though the current analysis found three straight-forward clusters, LPA can still be used to identify latent faultlines with more dynamic and mixed patterns. For example, it is possible that subgroups could have existed with different combinations of variable scores (for example high psychological safety, trust in leaders, and LMX, but low organizational justice). In an organizational setting, LPA could be used on an existing data set, including any or all variables, to examine and better understand the underlying organizational dynamics.

Data for the current study was used in part to inform later programming for the facility, meaning that all potential faultline variables, as well as outcome were conceptually related, as they were theoretically linked to provide guidance for organizational programming. The variables chosen as potential faultlines in the current study were conceptually distinct from the outcome variables, as the outcomes related specifically to group or organizational behaviors and outcomes, whereas the faultline variables related to more individual relationship dynamics or perceptions of organizational attributes. Outcome variables were identified with an underlying goal of comparing patterns of informal subgroups to formal teams, since they were measured at the formal team and organizational level. However, this comparison did not come due to fruition

since employees did not always report their formal team (this is discussed further in the limitations section). Therefore, though results are not as dynamic as expected, they still serve as a preliminary investigation of how configural alignments in PS, LMX, TIL, and OJ emerge, addressing the research question.

Based on the faultline literature, it was hypothesized that profiles identified in LPA would demonstrate statistically significant differences in team variables and safety climate confirming distinct latent subgroups (H1). It was also hypothesized that among the identified profiles, within-group agreement and between group-distinctions would be supported by $r_{wg(j)}$ and ICC one and two relating to PS, LMX, TL, and OJ, further confirming the treatment of latent subgroups (H2). Profiles were expected to influence measurement invariance of outcome variables (safety climate, team efficacy, and team communication quality), such that invariance was not achieved across profiles (H3). In line with the main tenets of faultline theory regarding effects on team outcomes (including communication and efficacy) and climates, members' perceptions of safety climate and team qualities were expected to significantly differ such that profiles with higher alignment would have higher scores (H4). A supplementary hypothesis was tested in line with hypothesis four, positing that across identified profiles, members' reported safety behaviors, including error disclosure and counterfactual sharing, would significantly differ such that profiles with higher alignment will have higher scores (H5). Support was found for all hypotheses except hypothesis three, which received only partial support.

Key findings included three profiles, identified by LPA, that may reflect distinct latent faultlines within the organization. Profile three had the highest scores in PS, OJ, TIL, and LMX, followed profile two and then profile one. Profile alignment was calculated after identification, demonstrating that profile three also had the highest alignment in PS, OJ, TIL, and LMX,

followed by profile one and profile two, as demonstrated by both ICCs one and two and $r_{wg(j)}$. Results of ANOVAs demonstrated a significant difference in outcomes between profiles, supporting hypothesis one. ICCs one and two and $r_{wg(j)}$ indicated that based on PS, LMX, TIL, and OJ, profiles had satisfactory within-group agreement, that the amount of variance in an individual response attributable to group membership was satisfactory, and that group means were reliable, supporting hypothesis two. Measurement invariance was achieved across profiles for team markers, but only weak invariance was achieved across profiles for safety climate, meaning that hypothesis three was only partially supported. This supports past research that suggests climate perceptions are influenced by faultlines (e.g., Beus et al., 2012). However, this indicates that group differences – at least those measured at the team level – were not just due to measurement differences, making some conclusions more reliable. Finally, results of Tukey's HSD testing demonstrated that profiles with higher alignment scored higher in safety climate, team communication quality, and team efficacy, supporting hypothesis four. Supplementary analyses were conducted to determine whether profiles significantly differed in terms of safety behaviors (error disclosure and counterfactual sharing), such that profiles in higher alignment had higher scores. Results of Tukey's HSD testing demonstrated that they did, supporting hypothesis five. Support for hypothesis five is especially interesting, since it indicates that the identified faultlines may be active; they lead to actual differences in safety behaviors, supporting past research. However, since these behaviors were self-reported, and relate to the group rather than the individual, this finding would need to be supported in future research with objective measures of individual safety behaviors.

Results suggest that LPA is an appropriate method for identifying faultlines in biosafety organizations, where safety-related indicators may serve as dividing lines between groups.

Results also suggest that these faultlines influence both team communication quality and efficacy and organizational climate profiles (with support for H4) and safety behaviors (with support for H5). Measurement invariance was only partially achieved, indicating meaningful differences in outcomes across profiles for team variables; perceptual differences may be truly associated with team attributes, not necessarily measurement differences.

Theoretical Implications

Theoretically, results provide support for Social Identity Theory, the core theory of faultline research. Specifically, faultlines create meaningful subgroup boundaries beyond demographics, triggering in-group/out-group dynamics based on employee perceptions of organizational attributes. For example, in the current study, perceived differences in employee-leader relationship quality, trust in leaders, organizational justice, and/or psychological safety result in differential team outcomes and behavior. This challenges the assumption that subgroup formation is driven primarily by demographic faultlines, extending faultline theory to include non-demographic faultlines more concretely. The profiles reflect distinct collective sensemaking patterns about leadership, fairness, and psychological safety, suggesting that in-group and out-group differences are a catalyst for subgroup formation.

Results also support tenets of less popular categorization theories. For example, results support the Categorization-Elaboration Model. Specifically, they demonstrate that subgroups form based on grouping of any perceivable attribute, since profiles formed based on patterns in organizational attributes, rather than demographic attributes. However, the current study did not examine the elaboration component of CEM, or cross-categorization so it is unclear how these same attributes – or indeed others – could be leveraged to reduce subgroup formation. Regarding Social Categorization Theory, the inclusion of LMX specifically may support SCT, as it

highlights how salient differences between oneself and others regarding supervisor relationships can lead to in-grouping. Results may also lend some credibility to Optimal Distinctiveness Theory, since within-group and between group differences were supported; they may indicate that people personally identified with their own groups and were distinct from groups that they don't identify with. It may also explain why shared mental models were influenced such that profiles had differential outcomes, but not all profiles lead to measurement differences; people may have unknowingly balanced their assimilation and distinction within and between groups, such that the teams had a shared mental model, but the organization did not.

An essential consideration for faultline research is measurement invariance. Faultlines carry great implications for psychological measurement; if they can affect the group-level aggregation of individual scores, measurement of several key organizational variables (such as specific climates) may need to be approached with caution or explicitly consider faultlines during measurement invariance testing. In the context of the current study, an interesting component of the design is that it assumes faultlines affect measurement invariance such that configural invariance is not achieved. However, results differ from previous research indicating that faultlines may impact shared mental models such that group-level aggregation is inappropriate; in the current context, group-level variables achieved measurement invariance, but organizational-level variables did not. Measurement invariance and high agreement indices for team communication quality and efficacy found in the current study suggest that while constructs are understood similarly within subgroups, they are experienced differently across faultlines, but perhaps only for measures aggregated at the organizational level (safety climate). This indicates a shared sensemaking process, but differential behavioral outcomes. In terms of shared mental models, the identified latent faultlines may represent divergent, but internally coherent mental

models regarding relational norms and expectations, such that team communication quality and efficacy are not influenced by faultlines, but climate perceptions are. An alternative assumption could be that faultlines have a big enough effect on team attributes that they influence item-level understanding across groups, in which case measurement invariance is achieved, but group-level aggregation is still inappropriate. Future research could examine whether this is the case by investigating scale structures and structural invariance. However, based on what is available in the current study, differences in safety climate, team effectiveness, and team communication quality (as well as ED and CFS) suggest that these incompatible models hinder coherent climate perceptions from forming. This finding, again, aligns well with literature suggesting that faultlines influence the sense-making process, and perhaps shared mental models (Beus et al., 2012; 2023).

Practical Implications

Practically, the identification of latent profiles is important to biosafety organizations. In the current study, the profiles indicate largely separable groups with meaningful differences in perceptions of broad team level outcomes. In the context of a biosafety facility, these differences may serve as small, avoidable risks that can be addressed early to avoid faultline activation and critical incidents. In fact, it may be beneficial to promote efforts to identify dormant faultlines since it is easier to prevent faultline activation than it is to address subgroup entrenchment (Wu et al., 2025). Therefore, this type of identification can be used in a preventative manner; early faultline identification may help to avoid perceptual differences that could result in critical safety incidents. Results provide support for the efficacy of finite mixture modeling in faultline identification, especially as a preventative measure. Specifically, LPA demonstrated great use in identifying underlying groups within existing data. In the current study, specific indicators were

explored as potential faultlines, but LPA could be leveraged to find latent faultlines in any data without prior assertion of what they might be. This approach may be particularly valuable in high-risk industries where prior knowledge of groups is unknown, but identification could be essential for prevention strategies. This could be especially useful for leaders who may not be completely in tune with relational differences or differences in safety indicators within their teams.

Further, profiles identified in LPA can be examined to compare differences; leaders could use the information to determine how and whether groups differ with subsequent testing (e.g., ANOVA or t-tests). Additionally, once identified, lower-scoring profiles can be targeted for intervention; leaders can try to improve relational or organizational attributes that aren't likely to be addressed in cross-categorization attempts, such as leader-member exchange. This highlights a practical use for a person-centric analytic approach. Following this approach, management could implement programming focused on promoting shared mental models, targeting areas of weakness, and preventing the emergence of faultlines; these would ensure that dormant faultlines are not activated, which would lead to problematic organizational outcomes.

Though results are preliminary, they point to an important implication of faultlines; they may result in perceptual differences of organizational climates, but perhaps not team processes. Practically, this may imply the need for dashboards that monitor employee attitudes and relational and interpersonal dynamics within organizations to prevent subgroup fragmentation. However, suggestions should also be framed such that they adopt a constructive tone, focusing on enhancing organizational learning and systems awareness rather than adopting punitive root-cause analysis. For example, dashboards should be promoted with the explicit intent for understanding the overall health of the organization and improving awareness of employee

needs. As another example, the organization could adopt an “open door policy,” promoting reporting behaviors for any concerns (including more informal or relational concerns) without fear of retribution or judgement. In bio-safety facilities, this type of system awareness could provide opportunity to identify dormant relational or safety-related issues that have potential to be problematic and perhaps even lead to a breakdown in cohesion, collaboration, coordination, and cooperation that could result in critical safety incidents. Specifically, in bio-safety facilities, management could provide online dashboards for individual anonymous reporting and monitoring of relational and safety indicators through official organizational channels, adopting business intelligence (BI) tools. Then, they could identify profiles and create interventions that would benefit lower-alignment profiles to enhance their shared mental model and promote efficient teamwork. For non-demographic faultlines, like psychological safety, increasing the size of employees’ perceived in-groups through efforts to enhance a shared mental model should lead to more aligned individual perceptions. These faultlines may in fact be easier to influence since they theoretically have greater capacity to change over time compared to demographic differences. However, attempts to cross-categorize may be insufficient in addressing deficits in safety-related indicators. For example, increasing the size of one’s in-group could be one step in increasing psychological safety, but leaders may also need to address their own treatment of safety reporting behaviors and related factors to adequately increase psychological safety. Still, leadership behaviors that inspire intra-team communication may be beneficial in promoting aligned, positive perceptions of organizational norms and practices. For example, leaders could model cross-functional communication with each other, and promote such collaboration within their own teams to increase the size of potential in-groups. Though biosafety facilities may have largely independent teams due to the nature of their work, organizational activities that promote

cross-functional collaboration may help to reduce faultline formation, in line with cross-categorization theory. For example, company-wide meetings could include short programming aimed at increasing knowledge of other teams and units, alignment in organizational goals, and promotion of transparent collaboration within teams, all aimed at enhancing organizational learning and awareness. Such activities could reduce faultline potential by aligning all organizational members, both within and between teams, in terms of organizational goals, knowledge, and awareness, minimizing the need for subgroup identification. Organizations could even explicitly emphasize the goal of alignment, framing it such that employees feel heard, included, and that their concerns are addressed so that everyone is on the same page. Biosafety organizations can foster open, collaborative cultures and encourage team leaders to be more collaborative with each other and create opportunities for teams to interact more, whether it be through developmental activities, restructuring work tasks, or offering social occasions outside the workplace. Such collaboration may reduce the potential for faultline activation based on subgroup entrenchment, ensuring that risk of critical incidents due to lack of communication or poor overall performance is reduced. In other words, ensuring that individuals are aligned would be an important first step in addressing deficits in safety or relational indicators; once members are better aligned, true differences in safety knowledge or practices can be better addressed.

However, an important caveat to note here is that faultlines emerge due to natural socialization processes. Though they result in informal, latent subgroups that can influence organizational outcomes and can be addressed with more opportunity for cross-categorization, it is not feasible to eliminate these natural socialization activities. As such, in the context of biosafety facilities, management can identify potential faultlines with finite mixture modeling and should make both preventative and mitigative action against faultlines, but should focus

organizational efforts on targeting those that highlight major risks or are high priority for the organization. For example, in the current study, profile one had low scores on many relational or organizational attributes, highlighting an area that leaders could target for improvement; leaders could work on their relationships with those in profile one. These types of efforts may align individual perceptions regarding deep-level, non-demographic factors by increasing the size of one's in-group. However, leaders should be careful not to place blame for negative outcomes on lower-scoring profiles, instead highlighting opportunities for growth and improving overall organizational health, and if feasible, even providing some level of training across the entire organization to ensure alignment in organizational attributes and relational characteristics. Additionally, organizations should shoulder the burden for improving employee perceptions of their organization, ensuring that a punitive root-cause approach is not adopted. In cases where scores are not concerning, it may be practical to simply ensure that latent groups are monitored to ensure that employee attitudes and needs can be properly addressed. For example, in the current study the overall organizational health as indicated by the measured variables was good, with hopes to maintain or improve scores, suggesting that faultlines may undermine overall health as indicated by differences in profile scores, but not raising significant red flags. In this case, lower-scoring profiles could be addressed, but managers should ensure that the organization adopts responsibility for improving employee perceptions. In short, the organizational context matters; next steps should be determined based on organizational needs and risk factors.

Limitations and Future Directions

Limitations include the sample size, which was insufficient for LPA, based on rules of thumb (Nylund et al., 2007; Spurk et al., 2020) and the use of cross-sectional data. However, the

small sample size was largely due to the voluntary nature of disclosure for the survey. Additionally, the selection of three latent profiles accounted for the small sample size because for alternative models (either four or five profile) there would have been too few observations per profile. Another limitation is that employees did not always disclose their official team or unit; all variables were examined only at the individual level due to a lack of formal clustering (e.g., team or group), since employees didn't consistently report this information. As such, comparisons between formal groupings and faultline-derived groupings therefore could not be made; it is difficult to identify informal subgroups within the more formal groups in the organization. However satisfactory levels of ICC 1, ICC2, and $r_{wg(j)}$ do definitively support these informal subgroups. This limitation could be addressed in future research, considering multi-level perspectives. Such research should consider adopting both formal hierarchical levels as well as hidden grouping variables. Mapping profiles identified in LPA into existing formal clustering variables could highlight whether identified subgroups are truly unique or if they reflect patterns found in formal groups.

Additionally, outcome variables and faultline variables were sometimes highly correlated, so significant effects found in ANOVAs and Tukey's HSD testing are not necessarily surprising. This is a limitation of the current dataset, which contains constructs that are largely safety related since it was used in part to inform organizational programming. However, findings still confirm that LPA could be used on existing data, reducing barriers to understanding organizational dynamics that may come with the need to collect new data. Future research could adopt a similar procedure on data with variables that are not entirely conceptually related, though empirical research should still aim to adopt a coherent theoretical justification. However, in an organizational context LPA provides a practical tool for understanding underlying organizational

dynamics. Finally, the study is limited in that it lacks an integration of demographic characteristics, which limits comparisons with faultlines based on other characteristics. However, this was also due to the voluntary nature of disclosure in the survey, since many participants chose not to disclose any demographic information, or to disclose it partially. Still, results serve as a preliminary examination of a unique method in an unexamined context. Future research could integrate objective outcomes measures (rather than self-report) to determine whether the identified non-demographic faultlines have the same effect on outcomes such as performance, behaviors, and attitudes.

Future research could additionally examine the faultline activation process, since the mechanism by which dormant faultlines become active is unclear. This could be examined under lab conditions, as ideally researchers should not aim to activate faultlines in high-risk organizations. Additionally, few researchers have devoted attention to whether faultlines change over time (e.g., Park et al., 2023). Future research within a high-risk context could examine whether faultlines evolve in high-risk environments, or how dormant faultlines became active following critical events or failures. It could also adopt a more longitudinal approach to examining faultlines, including objective outcome measures. This might help gain insight into how faultlines form or activate. It would also allow researchers to track their development and consequences of faultlines over time and within formal organizational structures. Additionally, the current study focused on single group identification, or alignment across all attributes within a group. Future research could examine multiple group identification within high-risk industries (i.e., whether having some out-group alignment can help address negative team outcomes). Future research could also integrate qualitative data to highlight the specific mechanisms behind faultline formation and change over time. This data could be used to explore why some

participants become more aligned than others on specific variables and may provide some insight into how to prevent subgroup fragmentation or entrenchment. It could also incorporate demographic or surface-level variables and explore whether those help to mitigate any negative effects associated with non-demographic or deep-level variables, in line with research indicating that sometimes group elaboration can help combat negative justice perceptions. Though the current study focused on non-demographic variables in order to better understand their impacts as faultlines (considering that they are largely overlooked), a more holistic understanding of faultline effects, and perhaps the activation and mitigation process could emerge by examining both types in tandem, especially since the two have some overlap.

Conclusion

The current study explored faultlines in a setting where safety is paramount. Though it is most useful to study dormant faultlines, then active faultlines subsequently (Thatcher et al., 2024), identifying dormant faultlines in these critical settings can be useful to preventing conflict and their activation. This is especially important considering the emphasis on preoccupation with failure in HRO or HRO-aspiring contexts and the increased utility of addressing dormant faultlines compared to active faultlines. Results support past faultline research and extend it by considering several key non-demographic variables whose alignments can lead to subgroup formation. These subgroups can undermine understanding and agreement on safety priorities, team interaction quality and efficacy, as well as safety behaviors. As evidenced by past research, the resulting breakdown in communication and unaddressed misalignment in psychological safety perceptions could lead to poor downstream outcomes for organizations in high-risk industries. These may act as barriers to forming a positive and congruent safety climate, as well

as to team effectiveness and communication quality, thereby compromising error reporting, constructive counterfactual sharing, and positive organizational learning.

The current study offers a unique perspective of faultlines, serving as a preliminary examination of non-demographic faultlines in biosafety facilities with a novel approach to faultline measurement. Key findings include that LPA is an appropriate method for identifying faultlines, that subgroups who are highly aligned may still perform well as a team and have similar organizational perceptions, and that faultlines may impact safety behaviors. Findings support past research indicating that faultlines form based on the alignment of individual variables, which can influence team and organizational outcomes. The current study provides an exemplar for future research on identifying potential faultlines in cases where risk-averse organizations wish to avoid latent failures.

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Appendix A - LPA Cluster Visualizations

Figure 5. Four Profile LPA Model

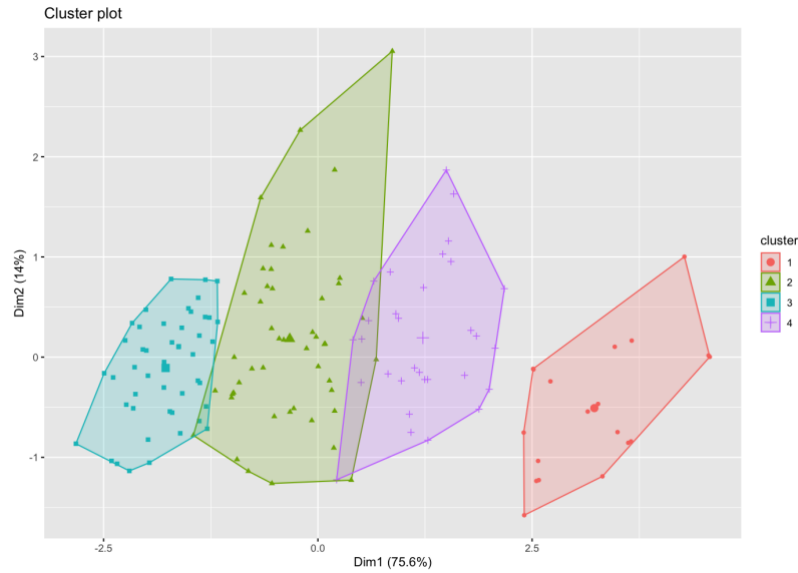


Figure 6. Five Profile LPA Model

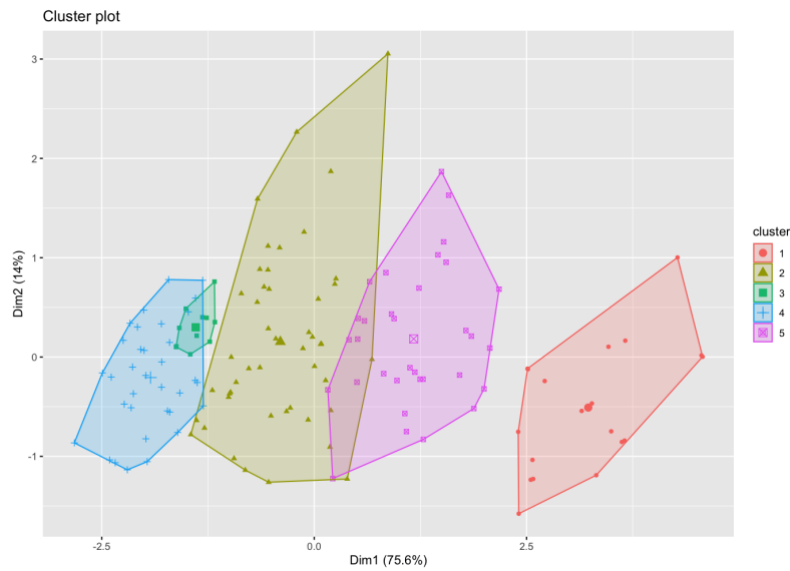


Figure 7. Visualization of Alignments: Three Profile Model

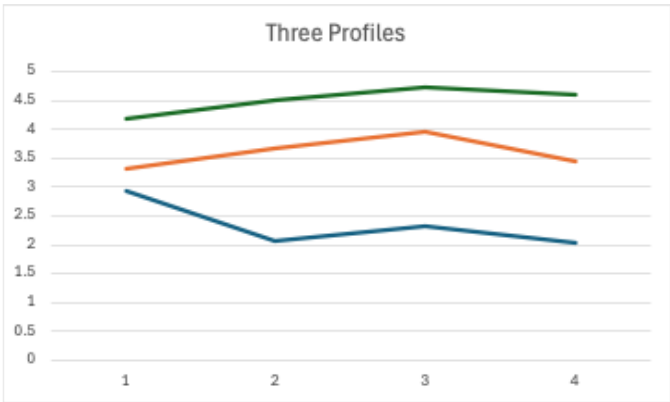


Figure 8. Visualization of Alignments: Four Profile Model

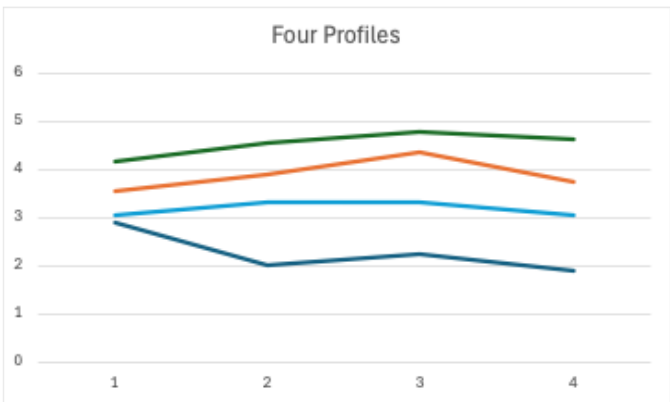


Figure 9. Visualization of Alignments: Five Profile Model

